A Response To Comments on the Federal Draft Underground Injection Control Permit to Puna Geothermal Venture and COSI (Constellation Operating Services Inc.) Puna Inc. June 1999.

According to Title 40 of the Code of Federal Regulations (CFR), Part 124.17(a), EPA shall briefly describe and respond to all significant comments on the draft permit or the permit application raised during the public comment period, or during the public hearings. What follows is EPA's response to the comments received. In instances where EPA received numerous comments on a topic, rather than listing each comment, the comments were combined. Under the section on "Specific Comments" on the draft permit, this document also specifies which provisions of the draft permit have been changed and the reasons for those changes. Unless otherwise noted, the term "well" refers to injection well and the numbered pages refer to the Administrative Record for this permit. The numbers in parentheses identify the commenters and their comments.

General Comments

1. Re: Public Hearing and Public Comment Period

- **1.a. Comment:** (28.7, 79.3, 91.1, 152.1) Requests were made for a 20-day, a 60-day, and an indefinate extension of the public comment period. A commenter also requested that the comment period should remain open until there is a decision on the requested contested case hearing on the Hawaii Department of Health's (DOH) UIC permit to Puna Geothermal Venture (PGV). The commenters thought that information discovered during the contested case hearing would be relevant to EPA's permit decision.
- **1.a. Response:** EPA reopened the public comment period for another 60 days in addition to the original 45-day public comment period. EPA decided not to grant an additional extension for the purpose of having EPA's public comment period overlap with the DOH's contested case hearing because it was unknown if a contested case hearing was going to be held, and when and how long such a hearing would be. In addition, if significant new information were submitted to EPA, EPA has the authority to modify, revoke and reissue, or terminate the permit. 40 CFR §§124.5, 144.39, and 144.40.
- **1.b. Comment:** (10.1, 142.5) One request was made for a public hearing on the proposed well pad locations submitted by PGV on April 3, 1998. Another request was made for a public hearing with better notification.
- **1.b. Response:** While the information on new well pad locations was mailed out to the entire PGV mailing list (approximately 120 people) and was published in two newspapers, there was only one request for a public hearing on this new information made during the 60-day reopening of the public comment period. Because there was not significant interest in holding another public hearing on the new information, one was not held. 40 CFR §124.12(a)(1). There was ample notification on the April 3, 1998 public hearing (refer to Responses 21a and 21b), so an additional public hearing was not held.
- **1.c. Comment:** (99.1, 136.1, 137.1) A couple of commenters found it disturbing that "preliminary approval" had already been given on the UIC permit prior to the public hearing. One commenter thought the public hearing should have held before the draft permit was issued.
- **1.c.** Response: Preliminary approval means that EPA made a preliminary decision to issue a permit based on the information in PGV's application (i.e. the application material did not lead to a tentative denial of the permit). Based on that information, EPA prepared a draft permit and solicited public comment on it in accordance with the public participation procedures in 40 CFR §124. Based on the information received during the public comment period, a decision is made to issue the permit without

modifications, issue the permit with modifications, or deny the permit application.

- **1.d. Comment:** (58.4, 59.2) One commenter asked what EPA is doing with the results of the workshops and public hearings?
- **1.d. Response:** The purpose of the informational workshops on March 28 and April 2, 1998 was to answer any questions that the public might have regarding PGV's draft permit and application. The purpose of the April 3, 1998 public hearing was to solicit comments from the public on PGV's draft permit and application.
- **1.e. Comment:** (89.1, 93.5) A couple of people protested the public hearing being held on a weekday and requested that future hearings be held on a Saturday to facilitate maximum public participation.
- **1.e. Response:** The public hearing occurred on a Friday evening because it was held jointly with the DOH which could only hold its public hearing on a weekday due to administrative constraints. Within those constraints, Friday evening seemed like a good compromise because it was followed by the weekend. Recognizing that there might be people who could not attend a Thursday evening informational workshop, EPA also held a Saturday workshop. As for future public hearings, if they are not joint public hearings with the State, EPA will consider holding them on a Saturday if there is significant interest in doing so.
- **1.f. Comment:** (7.2, 157.9) One commenter thought PGV's security guards had a chilling and disturbing presence, while another commenter appreciated the guards, having been harrassed and assaulted at prior geothermal hearings. The latter commenter objected to EPA and DOH not providing security guards.
- **1.f. Response:** EPA had two security guards at the April 2, 1998 informational workshop and the April 3, 1998 public hearing. DOH and EPA also notified the police about the workshop and public hearing as is normally done for public hearings on controversial subjects. On receiving complaints at the public hearing, EPA's public hearing officer requested PGV's security guards to maintain a lower profile which they did.

2. Re: Requiring a permit

- **2.a. Comment:** (108.4) PGV commented that it should not be required to obtain an EPA permit. According to PGV, it meets none of the criteria specified at 40 CFR §144.25(a) and §144.12(c).
- **2.a. Response:** EPA required PGV to submit a permit application under 40 CFR §§144.12(c) and 144.25(a), specifically §144.25(a)(3). Section 144.25(a)(3) authorizes EPA to require a permit for a Class V well if "The protection of USDWs (underground sources of drinking water) requires that the injection operation be regulated by requirements, such as for corrective action, monitoring and reporting, or operation, which are not contained in the rule." Part 144.12(c) authorizes permits for wells that may cause a violation of primary drinking water regulations. Additionally, EPA is authorized to require a permit under §144.12(d), which like §144.12(c) allows EPA to "(1) Require the injector to obtain an individual permit." However, §144.12(d) authorizes this based on learning "that a Class V well may be otherwise adversely affecting the health of persons...."

In this instance, EPA required PGV to obtain a permit for the following reasons. PGV's injectate (brine, condensate and non-condensible gases) contains arsenic, barium, cadmium, chloride, fluoride, lead, strontium, selenium, zinc, methane, ammonia, radon 222, cardon dioxide, and hydrogen sulfide (see preliminary assessment #40068 & #400070; monitoring reports located between #3000362-300756 & #301546-301558; and PGV's application #100780-100787). Toluene, ethyl benzene, o-cresol, p-cresol and trichloroethelene have been detected in the injectate (see PGV application #100943). Fluids and

gases from production wells KS-9 and KS-10 have contained benzene, toluene, ethyl benzene, and xylenes, in addition to other hydrocarbons (see NEIC report #400779, & #400791-400795). Injectate sampling indicates that Maximum Contaminate Levels (MCLs) have been exceeded for arsenic, barium, and selenium, and the MCL Goal for lead was exceeded (see PGV application #101942). Hydrogen sulfide is a potentially lethal gas as illustrated by the incident in Denver City, Texas where eight residents and one worker were killed by hydrogen sulfide leaking from an injection well on February 2, 1975 (see newspaper article #201383-201389).

Blowouts, the uncontrollable release of steam and brine, occurred during the drilling of KS-7 and KS-8, which were both initially drilled as injection wells (see records of communication #200113-200114, #200122, #200151, and #200356; video of KS-8 blowout #200118; conversion letter #200333; blowout report #100256-100296; and prelimary assessment #400063). The blowout of KS-8 fractured the formation just below the casing shoe at a depth somewhere between 2,103 to 2,128 feet (see PGV comments #600467-600479; NEIC inspection report #400526; and USGS report #100564). According to the aforementioned information that PGV supplied EPA prior to the issuance of the draft permit, the distance between the base of the USDW and the fractured formation is approximately 103 to 128 feet (see PGV application #100829 & #100895; and PGV handout #200745). As for impacts to groundwater from the June 11-13, 1991 KS-8 blowout, a 1994 U.S. Geologic Survey report (see #100528-100569, specifically #100564) noted that chloride concentrations and chloride/magnesium ratios in monitoring well MW2 increased in 1991 and 1992, as did temperature from June 1991 through 1992. Temperature continued to increase from September 1992 through April 1993 (see USGS report #100374). The USGS report stated that "The timing of these changes at MW2 and the proximity of this well to KS 8 (1,000 ft away) indicate a possible relation between the MW2 chemical changes and the blowout of KS-8 in June 1991. Although the uncontrolled steam discharge at the KS 8 wellhead lasted for only 31 hours, temperature measurements indicate that steam continued to leak upward past the 13-inch casing shoe at 2,128 ft until the well was finally guenched and plugged several month later." PGV plans to drill new injection wells which presents the possibility of future blowouts and possible impacts to the USDW (see letter #101634-101638; and letter #600238).

In addition to blowouts, there is always the possibility of the wells developing leaks and losing mechanical integrity (see report, starts at unnumbered page between #200023 & 200024-200051). PGV's April 26, 1993 Production and Injection Well Casing Monitoring Program (see #100981) states that "Contamination of the USDW's might occur if the casing strings are breached due to corrosion or mechanical failure or if there is a failure of the cement to seal the casing/borehole annulus above the zone of injection or production." Injection wells KS-1A and KS-3 initially had corroded casing and leaks (see letter #200103-200104; letter #200378; memorandum #200386-200387; record of communication #200399; PGV application #100961). Mechanical integrity was restored in these wells, but corrosion is an on-going process due to the presence of acidic ground water in fractures around 2,500 feet (see letter 200404-200405; PGV application #100961) and cathodic corrosion (see report, #200041-200042). More recently, on February 27, 1998, KS-3 lost mechanical integrity, when a leak developed in the tubing and the well had to be shut in (see record of communication #101688; letter from PGV to DOH dated 3/31/98).

Given the aforemention information, at a minimum, a permit is necessary to regulate the construction and operation of these injection wells. It can also help prevent exceedances of MCLs in the USDW (refer to Response 8.a regarding the aquifer being a USDW) and adverse health affects to nearby residents.

- **2.b. Comment:** (108.13) PGV commented that both §144.25(a)(3) and §144.12(c) are designed to ensure drinking water protection (primary drinking water regulations apply to public water system supplying "water for human consumption").
- 2.b. Response: Regarding the statement that 40 CFR §144.25(a) is designed to protect drinking water,

that citation states that "The Director may require any Class I, II, III, or V injection well authorized by a rule to apply for and obtain an individual or area UIC permit. Cases where individual or area permits may be required include...(3) The protection of USDWs requires that the injection operation be regulated by requirements, such as for corrective action, monitoring and reporting, or operation, which are not contained in the rule." It explicitly protects USDWs. So the intent is to not only protect public water systems (PWS), but to also protect the current and future sources of that drinking water--USDWs. This idea of protecting PWSs or USDWs is also reiterated in 144.12(e) which states "...the Director may take emergency action upon receipt of information that a contaminant which is present in or likely to enter a public water system or underground source of drinking water may present an imminent and substantial endangerment to the health of persons."

Additionally, 40 CFR §144.12(d) states that "Whenever the Director learns that a Class V well may be otherwise adversely affecting the health of persons, he or she may prescribe such actions as may be necessary to prevent the adverse effect, including any action authorized under paragraph (c) of this section," which includes (c)(1) "Require the injector to obtain an individual permit." At PGV, Class V wells have had the potential to adversely affected the health of persons. The blowout of KS-8, which was drilled as an injection well, caused an evacuation of nearby residents and an ambulance was summoned for two injured workers (see preliminary assessment #400063; record of communication #200348; newspaper article #200147; and timeline #200614). The blowout out of KS-7, which was drilled as an injection well, blew the floor boards off the drill floor, injuring three workers and sending one of them to the hospital (see record of communications #200113; and #200348). Both of these incidents resulted in actual adverse health effects while also potentially impacting the USDW (refer to Response 5.a).

The blowout of KS-8 fractured the formation just below the casing shoe at a depth somewhere between 2,103 to 2,128 feet (see July 20, 1998 Comments of Puna Geothermal Venture on the U.S. Environmental Protection Agency's Draft Class V individual Permit No. HI596002, Attachment 1; NEIC inspection report #400526; and USGS report #100564). According to the aforementioned information that PGV supplied EPA prior to the issuance of the draft permit, the distance between the base of the USDW and the fractured formation is approximately 103 to 128 feet (see PGV application #100829 & #100895; and PGV handout #200745). As for impacts to groundwater from the June 11-13, 1991 KS-8 blowout, a 1994 U.S. Geologic Survey report (see #100528-100569, specifically #100564) noted that chloride concentrations and chloride/magnesium ratios in monitoring well MW2 increased in 1991 and 1992, as did temperature from June 1991 through 1992. Temperature continued to increase from September 1992 through April 1993 (see USGS report #100374). The USGS report stated that "The timing of these changes at MW2 and the proximity of this well to KS 8 (1,000 ft away) indicate a possible relation between the MW2 chemical changes and the blowout of KS-8 in June 1991. Although the uncontrolled steam discharge at the KS 8 wellhead lasted for only 31 hours, temperature measurements indicate that steam continued to leak upward past the 13-inch casing shoe at 2,128 ft until the well was finally quenched and plugged several month later."

- **2.c. Comment:** (108.14) PGV commented that the threshold question under both parts 144.25(a) and 144.12(c), therefore, is whether there is a USDW to protect. Water quality is poor and the closest residential well is three miles away and in a hydrogeologically distinct aquifer.
- **2.c. Response:** Refer to Response 8.a (under USDW) which establishes the presence of a USDW at the PGV site.
- **2.d. Comment:** (108.3, 108.19) PGV commented that USDW protection is the only criteria that EPA may use in setting UIC permit conditions. Alleged health effects that are not related to USDW protection are also beyond the scope of the UIC program and are not proper subjects for inclusion in the permit.
- **2.d. Response:** There are a number of citations in the UIC regulations that show that protecting human health and the environment are also goals of the UIC Program, in addition to protecting USDWs. These

regulations include 40 CFR§ 144.12(d) which states that whenever the Director learns that a Class V well may be otherwise adversely affecting the health of persons, he or she may prescribe such actions as may be necessary to prevent the adverse effect. Part 144.40 states that a permit may be terminated if a determination is made that the permitted activity endangers human health or the environment and can only be regulated to acceptable levels by permit modification or termination. Part 144.39(c) indicates that the suitability of the facility location is considered in regards to whether it present a threat to human health or the environment.

Additionally, §144.51(b)(1) states that "In addition to conditions required in all permits the Director shall establish conditions in permits as required on a case-by-case basis, to provide for and assure compliance with all applicable requirements of the SDWA and parts 144, 146 and 124." These applicable requirements includes the ones cited above which are designed to protect human health and the environment regardless of whether a USDW is present. This is underscored by the fact that permits are mandatory for Class I, II, and III wells--even in areas where there are not any USDWs.

- **2.e. Comment:** (108.5, 108.9) PGV commented that the permit is not needed to ensure the protection of underground sources of drinking water (USDW). EPA's permit by rule for Class V wells fully protects USDW's.
- **2.e. Response:** Authorization by rule of a Class V injection well only requires the owner or operator of an injection well to inventory the well (40 CFR §144.26) and not endanger USDWs (40 CFR §144.12). In the case of PGV, EPA has determined that to protect the USDW, and ultimately human health and the environment, additional conditions are necessary. These conditions include: requiring financial assurance for the actual costs of plugging and abandoning wells; providing EPA with sufficient notice so that a representative can witness mechanical integrity tests (MIT); providing a UIC contingency plan; notification of upset conditions; and injectate and ground water monitoring.

For example, the Hawaii Department of Land and Natural Resources (DLNR) has required PGV to provide a financial assurance mechanism in the amount of \$250,000 for plugging and abandoning the two production wells and three injection wells (see record of communication #200326; and PGV application #100954). PGV's consultant estimated that plugging and abandonment of the injection wells would cost approximately \$140,000 per well (see letter #101554-101555). This shows that DLNR's financial assurance mechanism is insufficient to properly close two of the injection wells let alone the three injection wells and two production wells.

In addition, EPA has included notification conditions regarding PGV's MIT schedule so that EPA could have a representative witness the tests. Historically, EPA has had difficulty accessing PGV's MIT results (see record of communication #200652). On October 31,1998, EPA sent PGV a letter, which was followed by telephone calls, requesting notification of when PGV would conduct their tests so that EPA could witness them (see letters #101579 & #101583, record of communication #101587). PGV's response was that they had just done them (see record of communication #101613). However PGV has conducted MITs twice since then and has not notified EPA (see records of communications #102831, #102834 & #102933).

EPA has also included a contingency plan for the injectate should PGV not be able to use an injection well(s), because historically there has been much confusion as to what PGV would do with the injectate if the injection wells could not be used. In 1992, PGV said that it would dispose of brine to unlined pits during upset conditions (see inspection report #400000-400006) which was consistent with DOH's Authorization to Contruct which allowed disposal of brine on the ground (see memorandum #200386-200387). Other times, PGV stated that it would close in the production wells in case of an emergency (see record of communication #200360) or when the injection wells could not be used (see PGV's application #100834).

Additionally, EPA has included reporting requirements because there have been instances when PGV did not notify the necessary authorities during releases. Two of these instances resulted in an EPA Emergency Planning And Community Right to Know Act (EPCRA) civil complaint with a penalty against PGV (see press release #201495; and consent agreement and consent order #201498-201508). For the above reasons, among others, EPA deemed a permit necessary.

- **2.f. Comment:** (108.18) PGV made the comment that EPA failed to comply with its own regulations in requiring PGV to obtain a permit. EPA's notice to PGV does not include "a brief statement of the reasons for requiring a permit" as required by 144.25(b).
- 2.f. Response: EPA did provide a brief statement of the reasons for requiring a permit which is "the historical use of geothermal injection wells has shown that this type of well can endanger Underground Sources of Drinking Water (USDW)." A detailed and lengthy statement would have included the information in Response 2.a which states that the following information demonstrates why a permit is necessary. PGV's injectate (brine, condensate and non-condensible gases) contains arsenic, barium, cadmium, chloride, fluoride, lead, strontium, selenium, zinc, methane, ammonia, radon 222, cardon dioxide, and hydrogen sulfide (see preliminary assessment #40068 & #400070; monitoring reports located between #3000362-300756 & #301546-301558; and PGV's application #100780-100787). Toluene, ethyl benzene, o-cresol, p-cresol and trichloroethelene have been detected in the injectate (see PGV application #100943). Fluids and gases from production wells KS-9 and KS-10 have contained benzene, toluene, ethyl benzene, and xylenes, in addition to other hydrocarbons (see NEIC report #400779, & #400791-400795). Injectate sampling indicates that Maximum Contaminate Levels (MCLs) have been exceeded for arsenic, barium, selenium, iron, and manganese, and the MCL Goal for lead was exceeded (see PGV application #101942; and NEIC report #400984). Hydrogen sulfide is a potentially lethal gas as illustrated by the incident in Denver City, Texas where eight residents and one worker were killed by hydrogen sulfide leaking from an injection well on February 2, 1975 (see newspaper article #201383-201389).

Blowouts, the uncontrollable release of steam and brine, occurred during the drilling of KS-7 and KS-8, which were both initially drilled as injection wells (see records of communication #200113-200114, #200122, #200151, and #200356; video of KS-8 blowout #200118; conversion letter #200333; blowout report #100256-100296; and prelimary assessment #400063). PGV plans to drill new injection wells which presents the possibility of future blowouts (see letter #101634-101638; and PGV's 4/3/98 letter to EPA). In addition to blowouts, there is always the possibility of the injection wells developing leaks and losing mechanical integrity (see report, first page not dated but between #200023 & #200024-200051). Injection wells KS-1A and KS-3 initially had corroded casing and leaks (see letter #200378; memorandum #200386-200387; record of communication #200399; PGV application #100961). At EPA's insistence (letter #200400-200403; article #200410), mechanical integrity was restored in these wells, but corrosion is an on-going process due to the presence of acidic ground water in fractures around 2,500 feet (see letter 200404-200405; PGV application #100961) and cathodic corrosion (see report #100022; and report, first page not dated but between #200023 & #200024-200051). More recently, on February 27, 1998, KS-3 lost mechanical integrity, when a leak developed in the tubing and the well had to be shut in (see record of communication #101688; letter #102762; and letter #102797-102799). Given the aforemention information, at a minimum, a permit is necessary to regulate the construction and operation of these injection wells. It can also help prevent exceedances of MCLs in the USDW and adverse health affects to nearby residents.

A lengthy statement of why EPA is requiring a permit for PGV's geothermal injection wells would have also included information on a leaking geothermal injection well in Nevada (see record of communication #200084) and a leaking geothermal well in the East Mesa Field in California (see record of communication #200141), both of which endangered USDWs. A lengthy statement would have also described the 24 abandoned geothermal injection and production wells in the Geysers Field which EPA was called in to help close (see memorandum #201329; and newpaper article #201509). While the

main concern at the Geysers was the release of hydrogen sulfide, the well casings were corroding and could have endangered USDWs if any were present.

- **2.g. Comment:** (108.11) PGV commented that EPA has consistently viewed geothermal injection wells as posing a moderate to low risk to USDWs according to the 1995 Proposed Class V Rule. Calling PGV in for a permit conflicts with EPA's own conclusion in its Class V Wells Determination that Class V geothermal wells do not warrant further regulation by EPA.
- **2.g. Response:** According to the July 29, 1998 Federal Register (see Federal Register #500204-500238), on the Class V Proposed Rules, "EPA now believes that the 1995 proposal was inadequate to protect USDWs..." (see #500208). "Second, EPA believes that the 1995 proposed rule did not provide for adequate public health protection nationwide" (see #500208). EPA is also reassessing the risk posed by geothermal injection wells. "The second step in the strategy will involve continuing study to assess the size and impact of the Class V well universe not addressed by today's proposal. Other types of Class V wells are not cover by today's proposal because more information is needed to determine whether additional federal regulation for these other well types is necessary, and if so, what that additional regulation should entail. Therefore, EPA will undertake further study to assess risks, fill existing information gaps, and provide a factual basis for any further regulatory action" (see #500211). "Based on this study, EPA may find that some of these other types of Class V wells also pose a high risk" (see #500209). Additionally, EPA was also looking at geothermal injection wells nationwide. On a case-by-case basis, EPA can require a UIC permit for PGV's wells for the reasons given in Responses 2.a. and 2.e.

3. Re: Ability to Operate

Note: Regarding 3a and 3b, not all commenters expressed support or opposition. Some commenters just asked questions. A number of commenters submitted multiple sets of comments and those are included.

- **3.a. Comment:** (3.1, 4.1, 5.1, 6.1, 8.1, 9.1, 16.2, 18.1, 21.1, 24.6, 25.2, 26.1, 34.2, 47.1, 54.4, 56.9, 57.9, 65.1, 66.1, 67.4, 68.1, 69.1, 70.1, 71.1, 72.1, 78.1, 79.2, 85.11, 92.1, 93.1, 95.1, 96.1, 97.3, 99.8, 102.1, 105.1, 109.4, 113.4, 116.6, 117.1, 118.1, 120.1, 121.1, 125.1, 129.1, 135.1, 137.2, 138.2, 142.10, 147.1, 151.1, 154.1, 160.1, 161.1, 171.1) Many commenters requested that EPA deny the permit [application], disallow new wells, or voiced their opposition to the project.
- **3.a.** Response: EPA does not have the authority to deny a permit unless operations endangers human health or the environment, including the USDW, and this endangerment cannot be mitigated through permit conditions (40 CFR §§144.12(d) and 144.40(a)(3)). EPA believes that the conditions in the UIC permit ensure that as long as PGV is in compliance with the conditions, PGV should not endanger human health and the environment, including the USDW.
- **3.b. Comment:** (1.1, 2.2, 7.4, 12.1, 19.1, 20.1, 22.1, 23.1, 28.5, 32.1, 33.1, 35.1, 36.1, 37.1, 38.1, 39.1, 40.1, 41.1, 43.1, 44.1, 45.1, 46.1, 48.1, 50.1, 51.1, 58.3, 59.4, 60.1, 61.1, 62.1, 73.1, 74.1, 76.3, 77.1, 82.1, 83.1, 87.1, 88.1, 103.1, 104.1, 110.1, 111.3, 114.2, 130.2, 131.1, 132.1, 146.2, 149.1, 153.1, 155.6, 156.7, 157.8, 158.1, 159.1, 163.1, 164.1, 165.1, 166.1, 170.1) Many commenters requested that EPA grant the permit, approve new wells,and voiced support for the project.
- **3.b.** Response: EPA is issuing a final permit.
- **3.c. Comment:** (92.1) Native Lands Institute commented that the permit should not be issued unless it can be shown that the injection system does not endanger the public and the environment and the whole plant can operate safely because the injection wells are an integral part of the plant and therefore cannot be considered and permitted in isolation.

3.c. Response: EPA believes that as long as PGV is in compliance with the conditions in the UIC permit, its injection operations should not endanger human health and the environment, including the USDW. As for issuance of the UIC permit being contingent on the safe operations of the entire plant, the extent that the UIC permit governs other plant operations is addressed in 40 CFR §144.51(e) which specifies that "The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of the permit. Proper operations and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions fo the permit."

4. Re: Permitting authorities

- **4.a. Comment:** (17.1, 28.3, 38.2, 44.2, 45.2, 49.5, 58.1, 59.1, 63.1, 133.1) A few commenters thought that having a State and Federal permit is redundant. They commented that DOH's requirements on PGV's are equal to or more stringent than those in EPA's proposed permit. The responsibility of how the injection wells are drilled should be left with the appropriate State and County agencies. PGV said that it is already intensely regulated by the Clean Water Program, DOH UIC Division, i.e., the Water Branch.
- **4.a. Response:** Under the Safe Drinking Water Act and its amendments, Congress gave EPA primary enforcement responsibility, or primacy, for the UIC program in Hawaii until the time that Hawaii receives primacy. Hawaii does not have primacy for the UIC program.

The UIC Program in the Safe Drinking Water Branch of the Environmental Management Division of DOH does not require a financial assurance mechanism to guarantee that adequate funds are available to properly plug and abandon the injection wells, whereas PGV's consultant has estimated that plugging and abandonment of the injection wells will cost approximately \$140,000 per well (see letter #101554-101555). Also, it does not require a contingency plan of PGV that stipulated what would happen to the brine, condensate and non-condensible gasses if they could not be injected into the wells. EPA permits also require public review and comment of all modifications that are not considered "minor" as defined by \$144.41. EPA permits also address corrective action of improperly plugged and abandoned wells.

Both the EPA draft permit and the DOH permit renewal have been crafted to minimized duplication of efforts on PGV's part. Originally, EPA and DOH considered combining federal and state requirements in one permit. However, upon further investigation, it was determined that joint permit can only be done with a state that has primacy (40 CFR §124.4[c][1]). As noted above, Hawaii does not have primacy. Additionally, EPA's and DOH's regulations and statutory authorities differ regarding the permitting process, participation process, appeals and contested case hearings, emergency powers, and financial assurance (for EPA, Safe Drinking Water Act Amendments of 1996 and 40 CFR §§124, 144 & 146; for Hawaii, Hawaii Revised Statutes (HRS) 340E & 340 F and Hawaii Administrative Rules (HAR)11-23, 11-62, 13-183 & 13-185).

- **4.b. Comment:** (108.17) PGV commented that the EPA permit does nothing to further USDW protection and there is no potential risk to a USDW that is not already adequately addressed by PGV's state UIC permit.
- **4.b. Response:** Refer to Response 4a regarding additional USDW protection provided by the EPA permit. In addition, the EPA permit allows EPA to witness the mechanical integrity tests which determine if the injection wells have integrity or are leaking.
- **4.c. Comment:** (56.8, 157.7) The comment was made that DLNR has been involved in well drilling regulation in the past yet the commenter didn't see DLNR's role mentioned anywhere in the draft

permits. There were State and County jurisdictional issues during the crisis created by the 1991 blowout, particularly between DOH and DLNR. A permit should not be issued because State and County agencies, and Federal jurisdiction has not been established and recognized.

4.c. Response: Refer to Response 4.a regarding EPA having primacy of the UIC program in Hawaii. While DOH does not have primacy, it has developed a state program to regulate injection wells, whereas DLNR has the state program regulating production wells.

5. Re: Individual Versus Area Permit

- **5.a. Comment:** (108.6) PGV commented that it should not be required to get an individual permit, but rather requests an area permit.
- **5.a. Response:** It is at the discretion of EPA whether an individual or area permit is issued (40 CFR §144.33). This is what the term "may" means in "The Director `may' issue a permit on an area basis..." (§144.33(a)). Requiring an individual permit for PGV is also EPA's perogative under §144.12(d) which states "Whenever the Director learns that a Class V well may be otherwise adversely affecting the health of persons, he or she may prescribe such actions as may be necessary to prevent th adverse effect...." In addition, 40 CFR §144.12(c)(1), which EPA used to require a permit application from PGV, explicitly states that the injector will be required to obtain an individual permit.

On July 31, 1996, PGV applied for an area permit is for an unspecified number of wells and did not identify the location of any of these wells. EPA initially thought it could issue an area permit which limited the number of wells and required the location of the new wells to be identified (see letters #101141-101147 & #101148-101150) However, in a November 1997 memorandum regarding area versus individual permits, EPA's attorney Lisa Castanon advised that an area permit could allow PGV to drill an unlimited number of injection wells anywhere within the property boundary (see #101608-101612). After considering this information and discussions with PGV (see memorandum #101619; record of communication #101620-101621), EPA decided that it would issue a draft individual permit for the same number of wells that PGV had requested from DOH to avoid inconsistent State and Federal permits (see Application for Approval-to-Construct for Seven (7) Injection Wells #101499-101552).

EPA also required an individual permit based on the blowouts of injection wells KS-7 and KS-8 (see records of communication #200113-200114, #200122, #200151, and #200356; video of KS-8 blowout #200118; conversion letter #200333; blowout report #100256-100296; and prelimary assessment #400063). Both DOH and the independent technical investigators, who reviewed the KS-8 blowout, refered to the KS-7 incident as a blowout (see record of communication #200113; and blowout report #100263). The KS-7 incident, which lasted for 15 minutes (see timeline #200646) also meets the definition of a blowout (see blowout report #100275 & #100278; report #100022; and report #200035). At one point, PGV also characterized the KS-8 incident as a "kick" and "uncontrolled flow event" (see NEIC report #400721).

As for impacts to groundwater from the June 11-13, 1991 KS-8 blowout, a 1994 U.S. Geologic Survey report (see #100528-100569, specifically #100564) noted that chloride concentrations and chloride/magnesium ratios in monitoring well MW2 increased in 1991 and 1992, as did temperature from June 1991 through 1992. Temperature continued to increase from September 1992 through April 1993 (see USGS report #100374). The USGS report stated that "The timing of these changes at MW2 and the proximity of this well to KS 8 (1,000 ft away) indicate a possible relation between the MW2 chemical changes and the blowout of KS-8 in June 1991. Although the uncontrolled steam discharge at the KS 8 wellhead lasted for only 31 hours, temperature measurements indicate that steam continued to leak upward past the 13-inch casing shoe at 2,128 ft until the well was finally quenched and plugged several month later." Hiram Young (DLNR) said that KS-8 was killed with a cement plug in October 1992 (see record of communication #200618). A log of total dissolved solid (TDS) measurements in MW2 also

show an increase beginning around July 16 (see MW2 TDS logs #301614-301617). Following the February 21, 1991 KS-7 blowout, the MW2 TDS logs also shows a sharp increase in TDS concentrations (mislabeled feet, but in milligrams per liter) from March 4 through March 10, 1991. At KS-7 (which was temporarily used for monitoring after it was cemented back to 740 feet), an increase in temperature also occurs after March 1, 1991 and continues till April 10, 1991 (see KS07 temperature analysis #301648-301658). A similar increase in temperature is also seen at KS-7 from June 16, 1991 through June 20, 1991, with fluctuation occuring through mid-September 1991 (see KS07 temperature analysis #301648-301658), which is just after the underground blowout of KS-8 was controlled on September 9, 1991 (see timeline #200647) and the well was shut in and secured on September 30, 1991 (see memorandum #100319). KS-7 is approximately 500 feet from KS-8.

The information that EPA had when the draft permit was issued indicated that the distance between the base of the USDW and the casing shoe where the formation was fractured was 103 to 128 feet, which generated the statement that the formation was fractured near the base of the USDW. According to PGV's handout at a April 25, 1996 presentation (see PGV handout #200745), the base of the "`groundwater' aquifer" is at approximately 2,000 feet. PGV's application also states "The entire USDW, between the approximate depths of 600 and 2,000 feet..." and "The potential USDW is defined in this context as consisting of the uppermost aquifer(s) existing from the water table at approximately 580 feet below ground surface (bgs) to the `confining' zone at approximately 2,000 feet bgs" (see PGV application #100829 & #100895). The blowout of KS-8 fractured the formation just below the casing shoe at a depth somewhere between 2,103 to 2,128 feet (see July 20, 1998 Comments of Puna Geothermal Venture on the U.S. Environmental Protection Agency's Draft Class V individual Permit No. HI596002, Attachment 1; NEIC inspection report #400526; and USGS report #100564). According to the aforementioned information that PGV supplied EPA prior to the issuance of the draft permit, the distance between the base of the USDW and the fractured formation is approximately 103 to 128 feet. Since the issuance of the draft permit, PGV has supplied EPA with the KS-8 temperature log which indicates a highly permeable zone underlain by a impermeable zone at approximately 1,400 feet (see PGV comments #600467-600479). This appears to correspond to the base of the aquifer at KS-8.

Finally, issuing an area permit would eliminate public review and comment on the number of wells and their locations, because the exact number of wells and their location within the property boundary would not have to be given under an area permit (see memorandum #101608-101612). Given PGV's proximity to homes, the problems that it has encountered drilling injection wells, and EPA's commitment to involve the public in this process, EPA decided not to issue an area permit which would allow PGV to drill an unlimited number of injection wells anywhere within the property boundary and eliminate public review of certain information.

- **5.b. Comment:** (108.22) PGV contests EPA's refusal to grant an area permit on the basis that "[a]rea permits are generally issued for projects that have up to hundreds of Class II or III wells located in uninhabited or sparsely inhabited areas." Examination of geothermal and oil and gas injection operations in California demonstrate that area permits (or "project" permits as they are called in California) are and have been routinely granted for small groups of wells located in or near populated areas, such as Heber, the Geysers, and Susanville.
- **5.b.** Response: The basis for EPA not issuing an area permit to PGV is contained in the fact sheet statement "Having considered the history of the project (e.g., two blowouts while drilling `injection' wellsone of which fractured the formation near the base of the underground source of drinking water [USDW]) and the proximity of the wells to homes, the EPA does not consider an area permit for an unspecified number of wells to be protective of human health and the environment." For additional reasons why an individual permit is being issued, refer to Response 5.a. According to Ken Stelling with the California Division of Oil, Gas, and Geothermal Resources (CDOGGR), the State's "project" permits are issued only for slim-hole temperature gradient wells which are drilled for monitoring and/or coring purposes; geothermal injection and production wells are permitted individually (see May 6, 1999, record of

communication).

6. Re: New injection wells

- **6.a. Comment:** (99.2) A commenter requested information on where the new wells are going to be drilled.
- **6.a. Response:** Following the public hearing and at the start of the reopened public comment period, EPA mailed out a map of the existing and proposed well pads that PGV submitted at the public hearing when they requested nine new wells, in addition to an area permit.
- **6.b. Comment:** (28.4, 28.6, 30.1, 108.27, 131.2) PGV commented that it wants nine new wells and is resubmitting the well pad locations of the nine new wells. PGV understood from talking to EPA respresentatives on April 2, 1998 that the submission of the well pad information is sufficient for EPA to issue a UIC permit for the nine new wells in addition to the three existing wells without further public hearings prior to the construction of new wells.
- **6.b.** Response: PGV first provided EPA with the well pad map on January 15, 1997, stating that it was "The general locations and dimensions of well pads where injection wells may be drilled, constructed, operated or used for reservoir monitoring" (see letter #10178-10183). This was followed by a September 29, 1997 letter (see letter #1011556-101563) further clarifying how the map could be used. The letter stated "Note that at EPA's request..., PGV submitted a site map showing the location of prospective/possible wellpads on which future injection wells might be placed. However, PGV did not intend for the map to be used by EPA for the purpose of restricting the authorized `area'" of where wells could be drilled. Because PGV did not want EPA to limit injection wells to the identified well pad locations, EPA did not have a map identifying where all new wells would be drilled or converted. PGV's understanding that submission of the well pad location information automatically results in a final decision for a permit with nine new wells is incorrect. EPA clarified this issue in a May 20, 1998 letter to PGV (see letter #102826-102827).

In August 1997, PGV requested seven new wells from the DOH. On April 3, 1998, PGV requested nine new wells from EPA, in addition to requesting an area permit for an unspecified number of wells. To be consistent with the DOH permit, EPA will grant seven new wells and modify the duration of the federal permit to five years (refer to Response 24.a). As for PGV's request for an area permit, refer to Response 5.a and 5.b.

- **6.c. Comment:** (21.2, 47.2, 93.6) A few commenters requested that new wells be withheld until the permit is systematically reviewed further, safe operations are demonstrated without upset conditions, noncompliance in the NEIC report is addressed, or/and an adequate emergency response plan is in place .
- **6.c. Response:** EPA believes it currently has enough information to make a determination. However, the final permit contain Condition II.A.2 which enables EPA to consider public comments on EPA's review of PGV's and the County of Hawaii's emergency response plans prior to approving new wells. Additionally, EPA can consider new information whenever it becomes available, and this consideration could result in the modification, revocation and reissuance, or termination of the permit (40 CFR §§124.5, 144.39 and 144.40).

As for having experts review PGV's compliance with regulatory programs and safety concerns, EPA's UIC Program generated independent reviews of the plugging and abandonment of abandoned wells and PGV's mechanical integrity testing program (see reports #201001-201063 & #200952-200969). EPA also had independent experts review PGV's and the County of Hawaii's emergency response plans and has solicited comments on that review (see Report on the Review of Hawaii'i County Emergency Operations Plan and Puna Geothermal Venture Emergeny Response Plan #401116-401431).

Response 32a addresses how this information will be used in approving new injection wells. EPA's National Enforcement Investigation Center (NEIC) also reviewed PGV's ERP, air and UIC programs and issued a report in 1996 (see NEIC reports #400428-401105). The UIC noncompliance was either minor noncompliance with the DOH UIC permit or issues that are addressed in the EPA UIC permit (refer to Response 14a for more details).

- **6.d. Comment:** (100.1, 109.2, 144.4) A couple of commenters requested that, if drilling is allowed, EPA permit only one injection well and review the effects/need of that drilling before granting any further wells. If EPA needs to approve existing wells on the basis of technical review, why must EPA approving all new wells now? Any new well should have its own unique, comprehensive UIC review.
- **6.d. Response:** EPA believes that it has enough information to permit seven new wells. If new information becomes available, EPA will consider it, and this consideration could result in the modification, revocation and reissuance, or termination of the permit (40 CFR §§124.5, 144.39 and 144.40). While EPA may give approval for a number of new wells to be drilled based on information at the time, each well is assessed upon completion and testing. Factors that are considered include, but are not limited to, the permeability of the injection zone, and whether the well has external and internal mechanical integrity. If a well lacks mechanical integrity and the operator cannot rework or repair the well so that it does, the well will not be approved for injection.
- **6.e. Comment:** (57.5, 65.7, 66.7, 92.8, 99.5, 99.7, 109.1, 113.1, 151.1) A number of commenters pointed out that PGV is located in a residental zone and new wells should not be allowed. There have been blowouts, kicks, collapsed casings, KS-8 rising 18 inches out of the ground, voids, cement failures, lost tools, circulation outside of the casing, casing leaks, collapses of the substrata, and leaking valves, all of which are potentially harmful to nearby residents. Allowing more wells to be drilled under these conditions would subject the nearby residents to danger. Other problems have included KS-7 and KS-8 being drilled without a permit, groundwater contamination from the KS-8 blowout as shown by a USGS report, dumping drilling effluent into unlined pits, using a rock muffler which was a slotted pipe in a trench covered with rocks, and not demonstrating mechanical integrity for wells.
- **6.e. Response:** There were problems with drilling earlier wells (refer to Comment and Response 3.a) and that is one of the reasons why EPA has required PGV to obtain a permit. If the facility endangers human health or the environment, including the USDW, its UIC permit can be modified or terminated (40 CFR §§144.12(d), 144.12(e), and 144.40(a)(3)). As for zoning, the PGV facility is located in a geothermal resource subzone and an agricultural zone that includes residences. This is a zoning conflict that need to

be addressed by the appropriate State and County land use and planning entities.

- **6.f. Comment:** (127.8, 143.5, 154.2) A couple of commenters were concerned about the safety of their community because of the uncertainty of the location of fault or fracture zones near the PGV proposed drilling sites. There was concern that a fissure be cracked causing magma to extrude or an eruption.
- **6.f. Response:** If done properly, wells can be safety drilled into and through faults and fractures. Examples of this are KS-9 and KS-10 which each intercept a fault or fracture. If done improperly, situations such as the blowout from KS-8 can result. DOH's Noncovered Source Permit contains a condition that requires PGV to employ good drilling practices with proper blowout prevention equipment and experienced personnel in the drill of the exploratory/developmental wells and drilling supervisors shall be certified in blowout prevention at a minimum of once every two years by a recognized training center (see Noncovered Source Permit). Condition III.E.5 of EPA's permit also requires adequate staffing and training. As for the possibility of magma entering a well, it is very unlikely, but it has happened (refer Response 10.a).
- **6.g. Comment:** (100.4) One person commented that prior to granting any further drilling, pre-existing

community safety provisions with the State and County, such as the Geothermal Management Plan, County Relocation, Element Report Recommendations, and Emergency Response Plan review, should be finished and implemented. They asked EPA to allow PGV to rework and use their existing injection wells so PGV can continue production without risks associated with drilling.

- **6.g. Response:** EPA agrees that plans should be finished and implemented. EPA has included modified condition II.A.2 in the permit which conditions approval of new wells on the completeness of PGV's Emergency Response Plan, while also considering comments received on EPA's review.
- **6.h. Comment:** (112.2, 127.1) Two commenters asked how long will the drilling take and whether people will be notified before the drilling begins.
- **6.h. Response:** The time it takes to drill a well will depend on a number of factors including the geology and problems encountered during drilling. As for notification, the County of Hawaii's Geothermal Resource Permit (GRP) Condition 23 states that "The permittee shall notify the Planning Department and any resident within 3500 feet of the permittee's project boundary who has previously requested such notice, at least twenty-four (24) hours in advance of the open venting of each geothermal well and pipeline cleanout and 14 days before commencement of drilling. Initial notification to residents shall be made in writing, offering the opportunity to be placed on the notification list. Any other person may request to be on the list..." (see GRP #100132).
- **6.i. Comment:** (112.3, 127.4) A couple of commenters queried will it be necessary to vent the wells before they are completed for injection?
- **6.i. Response**: The DOH Clean Air Branch regulates venting under their Noncovered Source Permit to PGV and should be contacted with this question.
- **6.j. Comment:** (92.10) The Native Lands Institute commented that PGV should be required to provide information about proposed construction of new injection wells or conversion of wells to the community at the same time that it submits such information to EPA for approval.
- **6.j. Response:** In PGV's permit application, there is a schematic for the proposed injection wells. Actual well construction may vary due to the conditions encountered during drilling. Any modified well schematics that EPA receives becomes part of the permit in Appendix A and would be public documents under 40 CFR §144.5(b)(2). Anyone can request this information from EPA.
- **6.k. Comment:** (92.11) The Native Lands Institute commented that EPA should have a full year's notice of the proposed drilling of each new well in order to give EPA time to fully examine the possible threats to public health posed by each well and its construction.
- **6.k. Response:** EPA had approximately two and a half years in which to receive and review the permit application material. EPA believes that this is sufficient time for review. At the time of drilling and immediately there afterwards, EPA will review new well information, such as the actual construction and the permeability of the injection zone. In fact, now that PGV has officially submitted the location of the proposed injection wells, rather than submitting information to EPA 120 days in advance of spudding or converting a well, the permittee can send it to EPA 14 days in advance (this information would include the well pad and location on the well pad of the new injection well).
- **6.I. Comment:** (9.7, 56.7, 57.6) A couple of commenters noted that it is unknown whether a well will ultimately be an injection or production wells. One commenter asked what will happen if the intended injection well is found capable of production. Will it be cased for production while being drilled or for injection? Will it be counted as one of the seven new injection wells. Will the EPA have any regulatory authority if production wells are permitted instead of injection wells?

6.I. Response: If a well is drilled as an injection well, but it makes a better prodution well, PGV may decide to converted to a production well. If it were converted to a production well, it would not count as one of the seven new injection wells. If a production wells was converted to an injection well, before granting that conversion EPA would want to examine the same information that EPA would examine if the well were drilled as an injection well. This information includes both external and internal mechanical integrity tests, lithologic log, drillers log, injectivity tests, casing schematic, and the location of the well--both the wellhead and the downhole termination of the well. The final permit is modified to clarify these requirements. According to a September 21, 1992 memorandum from John C. Lewin (DOH) to William W. Paty (DLNR) (see memorandum #102702), all new wells (production and injection) are constructed with to production well standards with production well casing. If a well is permitted as a production well, EPA would not regulate it. DLNR would regulate the production well through its permit. However, if a production well causes a contaminant to be present in or likely to enter a public water system or a USDW which may present an imminent and substantial endangerment to the health of persons and the appropriate state and local authorities have not acted to protect the health of such persons, then EPA may take such actions as deem necessary in order to protected the health of such persons under EPA's emergency powers in the Safe Drinking Water Act.

7. Re: Abandoned Wells/Corrective Action

7.a. Comment: (85.9, 120.7) Two commenters said that the State of Hawaii DLNR has never bothered to ensure the proper capping off of unused wells at abandoned sites. Why should PGV be allowed to drill more wells when regulations regarding abandoned wells have been ignored? The commenters want

HPG-A, SOH-1 and all abandoned wells properly plugged before the new permit is given. They also want a time requirement to be in place for either fixing for use or abandoning correctly any well which is no longer in use.

7.a Response: It is the responsibility of the DLNR to enforce it's regulations regarding plugging abandoned geothermal wells. According to DLNR's Leasing and Drilling of Geothermal Resources §13-183-82(a) "The operator of any well shall promptly plug and abandon any well that is deserted, not in use, is deemed not to be potentially useful, is wasting geothermal or ground water resources, or is irreparably damaged." In addition, §13-183-82(b) states "The operator of a lease shall promptly plug and abandon any well that is deserted or not used or deemed useful by the board."

Generally, if any existing wells provide a vertical conduit for injectate from a new injection well and thereby endanger the USDW, the well must be plugged and abandoned prior to use of the new wells.

In the case of SOH-1, whether it is plugged is the decision of its owner DLNR. If SOH-1 remains unplugged, then the final permit will prohibit PGV from drilling a new injection well or converting a well to an injection well within 1/4 mile from SOH-1 until internal and external mechanical integrity is demonstrated for SOH-1. As for the other SOH wells, EPA is working with DNLR to determine further action for these wells.

HGP-A has a leak (see PGV application #100730) and should be permanently plugged and abandoned. Until it is properly plugged and abandoned, the modified permit will prohibit PGV from drilling any new injection wells or converting a well to an injection well within 1/4 mile of HGP-A. Presently, the owner of the well, the Natural Energy Laboratory of Hawaii Authority, is talking steps towards closing it.

8. Re: USDWs

8.a. Comment: (2.1, 17.2, 28.2, 44.3, 45.3, 46.2, 63.2, 111.1, 114.1, 130.1, 134.2, 146.1, 155.1, 156.2) A number of commenters stated that the shallow aquifer in the Lower East Rift Zone and at PGV is nonpotable. A couple of the commenters said that most people in that area use water catchments

sytems.

8.a. Response: An Underground Souces of Drinking Water (USDW) is defined in 40 CFR §§144.3 and 146.3 as "an aquifer or its portion: which supplies any public water system; or which contains a sufficient quantity of ground water to supply a public water system (PSW); and currently supplies drinking water for human comsumpition; or contains fewer than 10,000 mg/l total dissolved solids (TDS); and which is not an exempted aquifer." In other words, if the aquifer has fewer than 10,000 mg/l TDS and sufficient quantity to supply a PWS, then it is a USDW.

In promulgating the UIC regulations regarding USDWS (see Federal Register #500196-500197), EPA stated "The Agency has reviewed the current information on the drinking water use of aquifers containing high levels of total dissolved solids (TDSs). This review found that the use of water containing up to 3,000 mg/l TDS is fairly widespread. The Agency has also found that ground water containing as much as 9,000 mg/l TDS is currently supplying public water systems. EPA also believes that technology for treating water containing high levels of TDS is advancing. Therefore, based on this review and the legislative history of the Safe Drinking Water Act, the Agency still believes that it is reasonable to protect aquifers containing water with fewer than 10,000 mg/l TDS as potential sources of drinking water."

At the PGV site, north of the rift but within the rift zone, the shallow aquifer has a TDS content of approximately 450 mg/l at monitoring wells MW-1 and MW-3 (see PGV application #100898; and inspection report #400000). The TDS concentration of MW-1/MW-3 falls between those of the Pahoa and Kapoho drinking water wells (see PGV letter #101064-101065). Initially, MW-1 and MW-3 had a chloride concentration of 20 mg/l and NEIC sampling in 1995 indicated a chloride concentration of 19 mg/l (see USGS report #100547; water well index #200354-200355; and NEIC report #400990). Potable water lies north of the rift zone (see PGV application #100857) as indicated by the Pahoa test and drinking water wells which have chloride concentrations that range from 2 to 16 mg/l and are located approximately 3 1/2 miles northwest of the facility (see water resource inventory #200250-200258; and PGV application #100861). Approximately three miles to the northeast of PGV, a Kapoho drinking water well had a chloride concentration of 338 mg/l (see water resource inventory #200250-200258). Directly northeast and down-gradient from the PGV site, the monitoring well GTW-III initally had chloride concentrations over 500 mg/l (see PGV application #1100856 & #100863). At the PGV site, south of the rift but within the rift zone, the shallow aquifer has a TDS concentration of approximately 1,300 to 1,500 mg/l at monitoring well MW-2 (see PGV application #100903; and inspection report #400000). Groundwater samples taken from a depth of about 700 feet from geothermal wells KS-1, KS-1A, and KS-2 indicate TDS concentrations ranging from 2,200 mg/l to 3,100 mg/l (see PGV application #100857). According to the April 1990 Hydrologic Monitoring Plan, "There are a few shallow aquifer sources that provide ground water for drinking and irrigation purposes in the area in or south of the rift zone. The amount extracted at Green Lake is on the order of 50,000 gallons per day (County of Hawaii, Water Supply Department, 1989, written communication)" (see PGV application #100854). Two miles east-southeast of PGV, the Allison Well water, with a chloride concentration of 750 mg/l, has been used for irrigation (see PGV application #100855-100856).

Due to high recharge rates (150 inches of rain per year) and rapid subsurface flows, there is also sufficient ground water quantity in the PGV vicinity to be classified as a USDW (see thesis #600626; USGS report #100535 & #100540; and PGV application #100754). This is supported by pump tests at MW-1 and MW-3 that indicate extremely high transmissivities (see PGV application #100758).

Refer to Comment 8.e and Response 8.I regarding use of the USDW.

8.b. Comment: (108.15) PGV commented that the UIC program intended to provide flexibility with regard to USDW's "to recognize those situations where the aquifer or its portion may technically meet the definition [of a USDW] but in fact has no real potential to serve as a drinking water source."

Proposed Consolidated Permit Regulations, 44 Federal Register 34,244 and 34,248 (June 14, 1979). The prospect of using the shallow groundwaters in the vicinity of the project site is remote due to its nonpotability and the large volume of high quality fresh groundwater supplies immediately north of the rift zone.

8.b. Response: The citation that PGV quotes in 44 Federal Register 34,244 and 34,248 (see Federal Register #500190-500195, especially #500195) refers to what would become the aquifer exemption process and criteria referenced in 40 CFR §§144.7 and 146.4. In the summer of 1996, PGV investigated the possibility of exempting the USDW underneath the PGV site. Upon consultation, Lee Whitehurst of the UIC Branch of EPA in Washington, D.C. said that aquifer exemptions where only intended for USDWs that were being used for injection and met the aquifer exemption criteria. A USDW could not be exempted if injection were not occuring into it. At PGV, the injection zone is into a non-USDW aquifer that is at least 2,000 feet below the USDW. Injection does not occur, nor is it authorized to occur, into the USDW.

From the following, it appears that people will be using the USDW in the future. When the April 3, 1998 public hearing was held, the Puna District was in a severe drought. As a result of this, rainwater catchment systems dried up. Some people had water trucked in, while others waited in line for up to an hour at roadside spigots for water (see newspaper articles #201512-201514 & #201515-201517). It appears that the Puna area is subject to periodic droughts and accompanying fires (see newspaper article #201790-201792; and Hazard Mitigation Team Report #600670). Recently, a couple of roadside faucets used by the public for drinking water have been shut off because there is no more money in the County budget for this service (see newspaper article #202355-202357 "Puna residents fear losing clean drinking water"). These faucets were supplied by drinking water wells to the northwest of the Lower East Rift Zone. The spigots were installed to provide lead-free water to residents whose catchment systems are contaminated with lead leached from roofing and plumbing materials by rainwater acidified by volcanic emissions (see #200157). There are no drinking water lines for 7-8 miles along the coast from Kapoho to Kalapana (see record of communication #200421). EPA has also received calls, letters and comments from people who have installed a water well or plan on installing a well (see #200163. #201352, #201443 & #200628; public hearing testimonies #600147-600148 & # 600021). Therefore, EPA cannot say that the aquifer will never be used.

- **8.c. Comment:** (122.2) One commenter requested that a sample be taken at the water table as DLNR requires. Another commenter requested that the depth of the USDW be determined. They asked if EPA was requiring bailing samples at increasing depth to test water quality to determine if there is a 1,600-foot basal lens or a 1.2 kilometer fresh water source such as the one that was found during the drilling of the HGP-A well. (It was assumed that this water was confined in a dike system.) They ask how this information would affect the depth of new reinjection wells?
- **8.c. Response:** If DLNR requires a sample at the water table, EPA will request this information. Otherwise, we know the general quality of the USDW from existing wells. As for sampling with depth, it can be done, but it is expensive. If the permittee chooses to do this to further delineate the base of the USDW, that is their perogative. The TDS of the injection zone is approximately 32,000 mg/l, inferred from fluid produced from KS-1A (see table #200022). If a well was drilled in another location, and a USDW was found at 4,000 feet, this information would not affect the depths of new injection wells. PGV's current injection wells have cemented casing to approximately 4,000 feet.
- **8.d. Comment:** (9.8, 65.7, 66.8, 79.4) A few people commented that the drilling of new wells threatens USDWs. Blowouts, kickouts, broken well casings, ventings both expected and unexpected, well cleanouts, and lightening strikes have all produced releases to the environment of poisons in large quantities.
- **8.d. Response:** If a well is drilled properly, with experienced drilling personnel, then impacts to the

USDW are minimal. While a number of the foremention problems, e.g. open venting for well cleanout, come under the regulation of the DOH Clean Air Branch, if there is an endangerment to the USDW and human health or the environment, EPA has authority to regulate and enforce under the SDWA and UIC program.

- **8.e. Comment:** (16.1, 54.5, 64.1, 94.1, 95.2, 143.1, 144.1, 151.4) A number of commenters said that water from the aquifer that is affected by PGV is being used or will be used. One commenters said that there are a number of unauthorized wells using the ground water as was learned during the trial of *Aluli v. Lewin*. The people using unauthorized wells are reluctant to come forward. Two other commenters said that they had drilled wells or were going to drill wells and were concerned about PGV affecting the quality of the groundwater. Other commenters had concerns about the injectate poisoning groundwater and all species that relied on it.
- **8.e.** Response: The aquifer that is being used as the injection zone is below 4,000 feet, has a TDS of approximately 33,000 mg/l and therefore is not an USDW. No one is using groundwater from the injection zone. As for the shallower aquifer, which is an USDW, with the exception of possible impacts being detected after the earlier blowouts, groundwater monitoring wells do not indicate any impact from PGV's injection activities, with the exception of possible impacts following the 1991 blowouts (refer to Response 5.a). Therefore, if people are currently using the USDW, they should not be impacted.
- **8.f. Comment:** (3.6, 4.5) The comment was made that upset conditions, such as blowouts, and venting can affect underground sources of drinking water many miles away, even upslope depending on wind conditions. Contaminants from this will eventually find their way into USDWs.
- **8.f. Response:** While aerosol contamination of a USDW is possible, abundant fresh water recharge to the shallow aquifer would dilute contaminant concentrations (see USGS report #100563). An underground blowout in the vicinity of a USDW is more of a threat. Monitoring well MW-2 may have detected impacts from the KS-8 blowout (refer to Reponse 5.a).
- **8.g. Comment:** (155.2, 156.2) One person commented that using the available groundwater chemistry and temperature data, their estimate of the rate of natural discharge of geothermal fluids into the shallow groundwater sytsem amounts to about 1,500,000 lbs per hour of geofluid. Even a substantial casing leak from an injection well could only discharge more than a few percent of the natural daily discharge of geofluids into the groundwaters before it was detected with the monitoring procedure and brought under control. The impacts of such a leak would be further diminished by mixing and recharge processes before it reached any possible contact with the surface environment (at a well or spring). Even in the worst case of a well blowout, the deposition of geothermal fluids at the surface would be substantially diminished by dilution with surface recharge and it's impacts on the regional water quality would be minimal to undetectable.
- **8.g. Response:** While it is not known how large an area the commenter considered in their calculations, there are some areas where the ground water is relatively fresh. Ground water in the vicinity of MW-1 and MW-3 initially had chloride concentrations of 20 mg/l (see USGS #100547; and water well index #200354-200355) and appears to be meteoric water (i.e. rainwater) that has been heated by steam (see USGS report #100375-100376). As for the comments that that the impacts from leaks or blowouts would be minimal, this is consistent with a USGS report. However, there could be other impacts from leaks. According to the report, "Leaks of the fluid into the ground-water system through casing breaks or during well drilling operations would pose little threat of increased salinity in the ground-water system, but could produce increases in temperature and acidity. Acid ground-water conditions could cause severe casing corrosion at the water table..." (see USGS report #100563). Even if changes in salinity were minimal, the USGS maintains that the "Contamination of freshwater aquifers could occur from accidental releases of geothermal fluids and gases either through well blowouts or casing breaks." (See USGS report #100566) As for possible impacts to the USDW resulting from the

KS-7 and KS-8 blowouts, refer to Response 5.a.

- **8.h. Comment:** (24.1, 112.4, 113.3, 125.2, 139.1, 140.1) A few commenters stated that the Hawaiian Islands are laced with lava tubes and the lava is very porous. There can be no guarantees that the materials, including gases, being reinjected will not find their way into the aquifer or back up into different parts of the environment.
- 8.h. Response: The injection wells have casing down to approximately 3,900 feet. The base of the USDW is at approximately 2,000 feet. Between the base of the USDW at 2,000 feet and the top of the injection at 3,900 feet is approximately 1,900 feet of rock. The temperature gradient of this rock, as seen on temperature logs (e.g., KS-1A #301564; KS-3 #200211 & #301594; and KS-4 #301519) indicate that there are zones that are impermeable or solid (KS-1A 1,450-1,800 feet, 2,400-3,000 feet and 3,600-3,700 feet; KS-3 2,550-3,000 feet and 3,400-3,800 feet; and KS-4 2,000-2,200 feet and 2,600-2,900 feet). However, there are also fractures such as the ones encountered between 2,745 to 2,909 feet and 2,480 to 2,560 feet in KS-1A and KS-3, respectively (see PGV application #100961). Additionally, there are vertical-to-near-vertical fractures and zones of massive lost circulation exist in the area (see PGV application #100757, #100766-100768). According to PGV's application (see #100851 & #100877), "In the immediate site area, a north-south trending transverse fault and potentially associated dikes crosscut the easterly rift zone trend and are thought to be directly linked to the upward migration path for geothermal waters in the area (Figure H2-1)". The variable chemical composition of the USDW indicates that it has been geothermally influenced indicating that geothermal fluid, steam and noncondensible gases have migrated into the USDW (see PGV application #100759-100760; and USGS reports #100362-100527 & #100528-100569, specifically #100543 & #100554). As the commenters stated, there are also lava tubes and highly porous zones which could facilitate the lateral (i.e. sideways) migration of fluids.

According to PGV's application, "Fracturing is pervasive but of relatively low permeability by comparison to other geothermal reservoirs. Less than 5,000 feet below ground surface, which is within the transition zone, there are occurrences of minor permeability which are inferred, by their temperature, to be part of the geothermal system. PGV's production comes from a near-vertical fracture of very high transmissivity, which intersects the injection zone to the south of PGV's injection wells." (See #100762). "Below about 2,000 feet measured depth (MD), there is a noticeable decrease in the thickness of and a reduction in the porosity of the interflow rubblized breccias. This lithologic transition is due to the flow characteristics of the dominant pahoehoe lavas and is also induced by the effects of lithostatic compaction.... This transition zone also acts as a hydrologic barrier between the deeper geothermal fluids and the shallow groundwater. The hydrologic barrier minimizes, but doesn't eliminate, the upward movement of geothermal fluid from the geothermal reservoir to the shallow groundwater." (See #100766)

To summarize, while there are some geologic barriers keeping reinjected and naturally occurring brines and gases from reaching the USDW and surface, there are some conduits, such as fractures and faults, that facilitate or help upward migration. The brines and gases are being reinjected deeper than where they are produced which helps prevent them from reaching the USDW and surface. The gas concentrations are also thought to be diluted by mixing with fluids in the injection zone, and partially consumed by reactions with subsurace fluids and rocks (see report #100304).

- 8.i. Comment: (127.5) A commenter asked if there is a leak (in the casing), how far would it go?
- **8.i. Response:** The distance that leaking injectate could travel depends on the depth of the leak and the geology at that depth. The leak could be in an impermeable zone (solid rock) which would retard the migration of brine and gases, or it could be a permeable zone (e.g. lava tubes, fractures, interconnected pore space) which would facilitate migration of the brine and steam. This is one of the reasons that EPA and DOH have two ground water monitoring wells on-site and two standby monitoring wells off-site,

because we cannot say exactly where it would go at this point.

- **8.j. Comment:** (68.4, 144.8) Two commenters were concerned about drought making the impact of the injected fluids to the aquifer worse because there isn't as much recharge from percipitation to dilute the affect of the injectate.
- **8.j. Response:** This could be a concern if the injectate was being disposed of directly into the shallow aquifer or USDW. However, the injection zone is at least 4,000 feet below surface and the aquifer at that depth is not a USDW. The injection zone is approximately 2,000 feet below the base of the USDW.
- 8.k. Comment: A commenter asked if this permit is prohibiting PGV from discharging to the ground?
- **8.k. Response:** Yes. Permit condition II.D.5, Upset Conditions, expressly prohibits discharging injectate to the ground.
- **8.I. Comment:** (46.3, 108.16) PGV and one person commented that at EPA's and DOH's public hearings that were held on the draft UIC permits on April 13 [sic], 1998, no one raised a concern about the use of the shallow aquifer.
- 8.I. Response: EPA disagrees. At the DOH/EPA public hearings one commenter gave the following account "...I have a farm three miles downslope east of Puna Geothermal Venture in Kapoho. We have a community of people practicing and committed to community-sustainable agriculture. Sometime ago I drilled a well and will be installing a liner and pump in three weeks [sic] time. A neighbor will be drilling a well over the next three to four months. We've had a real lesson with this recent drought....Puna Geothermal Venture cannot guarantee that what they are proposing will not foul the quality of the groundwater aquifer. Puna Geothermal Venture cannot guarantee that the reinjection plumbing hardware will not corrode or malfunction and foul the quality of the groundwater aquifer." (See public testimony #600147-600148). Additionally, another commenter testified that "...the Big Island has experienced a severe drought for the past few months. Many climate experts and Hawaii State Officials believe the increased occurrence of droughts is not only due to El Nino but to global climate change. What it looks like is the droughts will get more frequent and more severe. My land is downstream from PGV. Our farm is going to need to use groundwater. This is going to be a USDW. I need to rely on clean water." (See public testimony #600021). At the public hearings, another commenter asked "How are we going to deal with droughts like we've been currently experiencing? What is going to be keeping that upwelling (of injectate) from coming into our drinking water after a 11-month or 2-year drought?...Whatever the cause is, we've been suffering from some droughts and I suspect we will be doing that in the future....I'm sure [the] migration [of] groundwater is not always rapid, nor are these heavy metals easily moved around, but they will continue to accumulate and they will continue to spread." (See public testimony #600048-600049). More people made comments about protecting the USDW. EPA has also received letters regarding the use of the County's closed Kapoho well and the drilling of a new well at Green Lake (see record of communication #201348; and letters #201352 and 201443) which PGV has copies of through a Freedom of Information Act request.

9. Re: Acidic Fluid in Fractures

- **9.a. Comment:** (9.6) A commenter asked whether the acidic fluids that caused a thinning of the casing in KS-3 from 2,480 to 2,560 feet could also cause corrosion in KS-4 which is on the same well pad?
- **9.a. Response:** Unless KS-3 intercepted a nearly vertical fracture filled with acidic brine, it is reasonable to assume that KS-4 also intercepts the acidic brine, especially since KS-1A intercepts acidic brine at three intervals between 2745 and 2909 feet. That is why the permit requires an annual pressure test where the water/nitrogen interface is depressed to 3,000 feet, rather than 2,000 feet as previously

done, and held for five hours to check for leaks. If the well does not have mechanical integrity, it well will be shut in until mechanical integrity is restored or the well is properly plugged and abandoned. Monitoring and maintaining mechanical integrity is more important than mapping the exact location of the acidic brine.

- **9.b. Comment:** (9.5) A commenter asked whether is was reasonable to suppose that the same acidic geothermal fluid that has attacked the casing of KS-1A is also attacking the casing of KS-9 and KS-10? If the casing of the production wells are breached, can't high temperature brine and steam escape and make their way up between the well casing and well bore, especially if a seismic event weakens the bond between the well bore and the casing?
- **9.b.** Response: The Hawaii Department of Land and Natural Resources (DLNR) is responsible for production well regulation. DLNR has copies of the latest mechanical integrity tests that were performed for KS-9 and KS-10, and according to Hiram Young, former engineer with DLNR, that information is available to the public (see record of communication #200825). If there was a leak in the casing of a production well and there wasn't a good cement bond between the casing and the formation, then steam and/or brine could travel upwards towards the USDW.

10. Re: Seismicity

- **10.a. Comment:** (9.3, 92.2, 99.6, 113.5, 116.1, 120.11, 121.2) A few people expressed concern regarding earthquakes affecting the injection wells. It was noted that the Seismic Zone where PGV is located is being upgraded from a 3 to 4, the highest there is. One commenter said that cracks open daily in a neighborhood near PGV. A strong seismic event, such as a magnitude 7 earthquake, would cause a number of disastrous results including casing failure and multiple blowouts which would result in the pollution of the USDW. It might not be possible to properly plug and abandon the well due to alignnment problems, permanently exposing the geothermal resource to the USDW. Given the high potential for volcanic events, seismic events, fractures opening, and subsidence in the area which could cause multiple geothermal well blow-outs and open venting of wells, PGV's operation is inherently unsafe no matter what conditions are placed on the permit. There is no existing technology that would be reliably effective in closing off such well blow-outs. Another commenter said that if an injection well is damaged due to an earthquake, PGV claims that it can close its production wells to end reinjection. A demonstration should be required.
- **10.a. Response:** In the Cerro Prieto Field in Mexico, an greater than magnitude six earthquake did not cause any well failure (see record of communication #101576). According to Jon Orn Bjarnason (see record of communication #101625-101627) who works for Orkustosnun, an Icelandic government agency that monitors geothermal projects in a rift setting similar to Hawaii's, there have been no magnitude 7 earthquakes near their geothermal fields, although they have had earthquakes of magnitude 4.5 associated with magmatic intrusions and volcanic eruptions along the rift. During one rifting episode, some geothermal wells became more active and produced more water. However, during the next rifting episode, a few wells quit producing. There was one instance where magma entered a well and ejected 3 to 4 tons of lava from the wellhead. During one eruption event, fluids became very acidic (pH of 1.4) and ate through a valve which caused a blowout. Eventually the well sealed itself as calcium carbonate percipitated from the fluid. Overall, it was more common for wells to quit producing rather than blowout during rifting episodes.

Constellation Energy (PGV's parent company) says that they would close the plant if a magnitude 6 earthquake occurred (see e-mail #101094). PGV states "In most geothermal fields (including Puna), the dominant permeability exists in faults, and the usual drilling strategy is to intersect the target fault at the planned total depth (bottom) of the well. To the extent possible, wells are sited and drilled to avoid faults intersections above the targeted completion zone. This strategy has been applied at Puna, and to our knowledge, none of PGV's wells crosses an active fault within the cased interval (generally from the

surface to 4,000 feet). One aspect of this strategy, as applied to the drilling of injection wells at PGV, is to maintain a near-vertical wellbore above the base of the confining layer" (see letter #101604-101605). If the injection wells did lose mechanical integrity due to a large earthquake, PGV could try shutting them in at the wellhead. If that didn't work, PGV could get a drilling rig and try to intercept the wellbore and kill the well that way. As for closing the production wells, according to Eric Tanaka of DLNR (see record of communication #102950), PGV does this annually when they run mechanical integrity tests. However, they watch the wells for problems such as pressure buildup. If there was a problem, they could run water into the well to quench it, but that could possibly kill the well and/or cause thermal shock.

The County's Geothermal Resource Permit requires that within 48 hours of a magnitude 6 (Richter Scale) or greater earthquake, all wells within 10 kilometers of the epicenter or eruptive center will be examined for any physical changes which would alter their downhole integrities and a report will be filled within 48 hours of the examination (see County GRP #100136).

10.b. Comment: (9.4, 65.6, 66.6, 92.4, 99.7, 139.2, 140.2) A number of commenters expressed concern over injection wells causing earthquakes. One commenter noted that injected water has been used in the past to deliberately triggering smaller earthquakes as a way to prevent larger ones. One commenter said that according to the U.S. Geological Survey's Report on "Earthquake Hazard Associated With Deep Well Injection", dated 1987, by Robert L. Wesson and Craig Nicholson, "Injection of fluids into deep wells has triggered earthquakes in documented instances... [t]he largest of these induced events was magnitude 5.5." They said that there has been an increase in earthquake swarms. There were a couple of comments about how injecting water into a volcano could cause an explosion. A commenter called for an immediate, investigation into the extent of the earthquake hazard associated with PGV's reinjection wells. New wells should not be permitted until this is done and reinjection should be halted until it is conclusively proven that reinjection poses not earthquake hazard. A full formal seismic and volcanic hazards risk assessment must be done before an informed decision can be made. PGV should bear the costs of the investigation.

10.b. Response: While injection wells can cause earthquakes (in the Geysers Field of California, it has been found that production wells have caused more earthquakes than injection wells), in most instances these earthquakes are very small. In the Geysers Field, where reclaimed wastewater is injected to recharge the geothermal reservoir, most of the earthquakes caused by this activity are magnitude one on the Richter Scale (see record of communication #102978). As one commenter pointed out, small earthquakes can relieve stress and reduce the possibility of a larger quake (Kathy Janick, U.S.Geologic Survey, per. com.). Regarding the 1987 USGS study (see #100049-100058), the permeability of the injection zone at PGV is greater than the "relatively impermeable" injection zone at the Rockly Mountain Arsenal near Denver, Colorado where the magnitude 5.5 quake occured. With higher transmissivity and storativity, a lower injection pressure can be used to attain the desired injection rate, and consequently, there is a lower potential for triggering earthquakes (see USGS report #100056). The other examples cited in the USGS report refer mostly to oil-recovery water-flooding operations where large arrays of wells are injecting at high pressures into small, confined reservoirs with low permeabilities.

Earthquake swarms in Hawaii have been typically associated with volcanic activity. Swarms of earthquakes from 1968 to 1975 near Puu Honuaula were probably related to magma movements in a secondary storage zone, temporarily isolated from the principal magma conduit of Kilauea's East Rift, and apparently of too small a size and intensity to perpetuate eruptions (see Koyangi, R.Y., Nakata, J.S., and Tanigawa, W.R., 1981, Seismicity of the Lower East Rift Zone of Kilauea Volcano, Hawaii, 1960 to 1980. USGS Open-File Report 81-984). As for the comments on injecting water into a volcano, there are already fluids under pressure in the injection zone, so the addition of more hot fluids will not cause an eruption. Conducting a full formal seismic and volcanic hazards risk assessment is outside of the scope of the UIC permit, however there are reports on these subjects, such as the October 1990 Hazard Mitigation Team Report for the Kilauea Volcano Eruption, Hawaii County, Hawaii, FEMA-864-DR-HI (see #600665-600682).

As for current injection activities, they are authorized by rule according to 40 CFR §144.24(b). New wells cannot be drilled until a permit is issued according to §144.11 and §144.31(a). A study on the extent of earthquake hazards associated with PGV's injection is outside EPA's authority.

11. Re: Injectate

- **11.a. Comment:** (141.1) A commenter from California asked what kind of water is being injected? Is it ground water from another area or treated waste water? Is the water cooler, hotter, or the same temperature as the geothermal well?
- **11.a. Response:** Geothermal brine and condensed steam from the production zone beneath the site are being injectioned. In the upper part of the well (above approximately 2,600 feet), the injectate is hotter than the formation. In the lower part of the well, the injectate is cooler than the formation.
- **11.b Comment:** (53.1, 99.4) Two commenters noted that in Hawaii the geothermal resource has toxic gases (e.g. hydrogen sulfide and radon), metals (e.g. lead, arsenic, cadmium, mercury, selenium, zinc and other heavy metals), benzene, acidic fluids, and high temperatures. They commented that there is a lack of a caprock which is supposed to allow for the safe reinjection of the hazardous waste.
- **11.b Response:** Regarding the presence of a caprock and its ability to prevent injectate from reaching the USDW, refer to Response 8.h. Wastes associated with the production of geothermal wells have been exempted from the federal Resource Conservation Recovery Act (RCRA) which governs the regulation of hazardous wastes. Therefore EPA would not regulate geothermal fluids as hazardous waste even if they did meet the RCRA criteria for hazardous waste. However, the State of Hawaii has chosen to be more protective and regulates these wastes through the DOH. Seeing as how most of the constituents in the injectate meet drinking water standards, they would also meet hazardous waste which are usually 100 times greater than drinking water standards. As for whether the injectate is a RCRA characteristic waste due to ignitability, corrosivity, and reactivity, contact the DOH for that information.
- **11.c Comment:** (155.4, 156.6) A commenter stated that the disposal of geothermal fluids by underground injection back into the geothermal reservoir is widely recognized as the most effective technology currently available for protection of the surface environment, including groundwater and surface waters from the impacts of geothermal power production. It is also recognized as an effective means of maintaining the long-term viability of the geothermal reservoir and for minimizing the long-term withdrawl effects on existing hydrologic processes (e.g. geysers, warm springs).
- **11.c. Response:** EPA agrees as long as the injection well is properly constructed and mechanical integrity is maintained.
- **11.d. Comment:** (99.3) A commenter asked how much liquid is being injected and where are the noncondensible gases going?
- **11.d. Response:** For the month of March 1998, 621,456,000 pounds of fluid were injected according to PGV's UIC injection Report for March 1998 to DOH. The noncondensible gases are being injected into the geothermal reservoir below 4,000 feet (see PGV application #100792).

12. Re: Monitoring

12.a. Comment: (57.10) A commenter asked would EPA staff witness the collection of samples? Would a waiver by the Director of having DOH personnel witness sample collection be allowed under the federal permit? To ensure quality assurance, no waiver to this condition should be granted.

- **12.a. Response:** EPA does not have the travel budget to witness the collection of all samples. Therefore, EPA's permit does not mandate that EPA personnel be present to witness sample collection. However, EPA will be conducting inspections during which samples may be collected. As for DOH's Director waiving the requirement of having DOH personnel witness sample collection, that is a State permit condition which is separate from the federal permit.
- **12.b. Comment:** (144.5) One commenter asked for a verification of the qualifications of the people doing monitoring and a certification that the samples and procedures were done within appropriate technical guidelines.
- **12.b. Response:** As we have done in the past, EPA will conduct inspections that include observing sampling and Quality Assurance/Quality Control (QA/QC) practices employeed by personnel taking injectate and groundwater samples for PGV. This will also include measures that test the laboratory's accuracy in analyzing the samples. The HMP, which is part of the permit, also states that the program will be managed in accordance with other similar environmental compliance monitoring projects to a standard similar to that expected by the EPA. In addition, DOH recently released conditions for sample collection and analyses (see conditions #102953-102955).
- **12.c. Comment:** (100.3, 144.6, 160.2) Comments were made that monitoring data should not be subject to the general condition provision for confidentiality (Part III.D.). Public access to monitoring data should be prompt and unrestricted. There should be real-time monitoring with public access 24 hour per day.
- **12.c. Response:** Information which deals with the existence, absence, or level of contaminants in drinking water (i.e. monitoring reports) could not be successfully claimed as confidential business information under 40 C FR §144.5(b)(2). This information is available to any member of the public on request. Whereas real-time monitoring is crucial in air monitoring for hydrogen sulfide, the parameters monitored under the UIC permit have to do with the protection of the USDW and permit compliance (e.g. only permitted fluids may be injected). There are already air monitors to detect any noncompliance with the UIC permit that would present an immediate threat to health, such as a leak in a wellhead or surface piping. The DOH Clean Air Branch should be contacted with the request for real-time air monitoring.
- **12.d. Comment:** (76.1, 160.3) Two commenter said that there needs to be constant monitoring of every thing.
- **12.d. Response:** The DOH has required bi-monthly and quarterly sampling and analyses of the injectate, including the brine and noncondensible gases, since PGV began operations. The DOH UIC Program has a complete set of the sampling results. A synthesis of the data, along with May and June 1996 sampling results, can be found in PGV's application material for the draft federal permit (see #100779-100787) and in monitoring reports forwarded from DOH to EPA (see monitoring reports located in the #300,000's). As for impacting groundwater, the injection zone is from approximately 3,900 to 7,300 feet, whereas the base of the USDW is at approximately 2,000 feet. As long as the mechanical integrity of the injection wells is maintained, injectate should not be getting into shallow groundwater from the injection wells. As for the mechanical integrity of the production wells, DLNR can be contacted for the results of those tests.
- **12.e. Comment:** (68.5, 144.7) Two commenters said that groundwater monitoring every six months seems not to be frequent enough to catch possible contaminants. The comment was made there is an increasing concentration geothermal contaminants in the groundwater around the wells and it will continued to accumulate and spread. The groundwater won't be checked for many of the constituents in the injectate and monitoring should be continued for all the groundwater monitoring wells for all the constituents. There should be a provision for immediate response if contamination is detected, whether in the groundwater or injectate, and not just a reporting that sets additional reviews in motion. The

immediate response should include a termination of injection.

- 12.e. Response: Under the previous DOH UIC permit, groundwater sampling was done quarterly. As for injectate sampling, Type I sampling (see Appendix H of the permit, #103037-103040, for what this includes) was done every month and Type II and III sampling were done every three months. After reviewing four years worth of sampling data, EPA and DOH decided to reduce ground water sampling to once every six months and injectate sampling to once every two months for inorganics and field parameters, and once every six months for organics. Pesticides and herbicides are the only analytes being dropped from the sampling program. Sampling frequency is being reduced because past sampling shows the injectate to be within drinking water standards for most constituents and groundwater sampling results were fairly consistent. As for contaminant concentrations increasing around the injection wells, the fluids that are injected are very similar to those already in the injection zone which is below 4,000 feet. Other than possible impacts following the KS-7 and KS-8 blowouts, groundwater monitoring has not detected any impacts from PGV's injection activities. For the reasons listed in Response 49.b, the permit requires continued monitoring at MW-1 and MW-2, with the option of using Malama Ki and GTW-III as monitoring wells if the situation warrants it. EPA will also conduct unannounced sampling inspections to independently gather injectate and groundwater data.
- **12.f. Comment:** (108.12, 112.2, 157.3) PGV and others commented that groundwater monitoring data, gathered before and after PGV began injection, show no impact to the shallow aquifer from injection practices.
- **12.f. Response:** While the groundwater monitoring data following the commencement of injection show no impact to the USDW (and highlight the importance of monitoring), groundwater monitoring previous to this indicates that there was an increase in salinity and temperature of the USDW detected at MW-2 following the 1991 blowout of KS-8 and possible impacts detected in KS-7 which was briefly used for monitoring (refer to Response 5.a). While the measurable groundwater impacts from leaks or blowouts could be minimal, there could be other impacts from leaks. According to one report, "Leaks of the fluid into the ground-water system through casing breaks or during well drilling operations would pose little threat of increased salinity in the ground-water system, but could produce increases in temperature and acidity. Acid ground-water conditions could cause severe casing corrosion at the water table..." (see USGS report #100563). Even if changes in salinity were minimal, the USGS maintains that the "Contamination of freshwater aquifers could occur from accidental releases of geothermal fluids and gases either through well blowouts or casing breaks." (See USGS report #100566)

13. Re: Mechanical Integrity

- **13.a. Comment:** (85.8, 120.6, 142.4) A couple of commenters said that the situation is virtually the same today as it was in the summer of '91 and the wells are still leaking. One asked if KS-3 was permanently broken. Another said that KS-3 has been leaking into the groundwater.
- **13.a. Response:** The 1997 mechanical integrity tests (MIT) conducted by PGV under DOH's permit indicate that all wells had internal mechanical integrity (i.e. there are no leaks in the casing, tubing, or wellhead) (see letters #301560-301605 & #301606-301613). Test results indicate that KS-1A and KS-3 also have external mechanical integrity. On February 27, 1998, KS-3 developed a leak in its tubing (hangdown liner) and was shut in. Geothermal brine did not enter the formation or the USDW (see letter #102797-102799). PGV's 1998 mechanical integrity tests indicated that KS-1A and KS-4 have mechanical integrity (see letter #301857-301902). A November 7, 1998 shut-in temperature test conducted on KS-3 shows that it has external mechanical integrity (no movement of fluids between the casing and the formation). A casing pressure test was conducted on KS-3 and the well appeared to hold pressure with a slight decline. PGV plans to finish conducting an injectivity test on KS-3 to determine if it is worth replacing the tubing which had the leak (personal communication, Chauncey Hew, DOH). If PGV decides not to replace the tubing, the well will be properly plugged and abandoned in accordance

with permit conditions II.F.1-4.

As for plugged and abandoned wells, an independent review by the U.S. Bureau of Land Management of the plugging and abandonment information for wells KS-1, KS-2, KS-7 and KS-8 has determined that these wells have been properly plugged and abandoned (see report #201001-201063).

- **13.b.** Comment: (65.3, 66.3) One commenter said that hydrogen sulfide embrittles metal and contributes to the breakdown of the PGV plant.
- **13.b. Response:** This is one of the reasons why EPA is requiring that continuous monitoring and annual MITs to ensure the integrity of the injection well casing and wellhead. The permit also has Condition II.D.2.c which states that "All piping, valves and faciliteis associated with injection operations shall meet or exceed API standards for the injection pressure and shall be maintained in a safe and leak-free conditions" and Condition III.E.5 on proper operation and maintenance.

14. Re: Compliance

- **14.a. Comment:** (142.8) A commenter said that regarding the NEIC report, PGV needs to attend to the four areas of noncompliance with UIC immediately or be shut down.
- **14.a. Response:** Those areas of noncompliance either have been attended to or will be in the permit (e.g. requiring a cooling coil during sampling of the injectate). In some instances, it is up to the State whether they want to enforce conditions in the state permit that were not being followed, for example, PGV not sampling for all of the constituents specified in the DOH UIC permit.
- **14.b.** Comment: (86.4) A commenter asked how can steam releases that happen during reinjection not be considered part of reinjection.
- **14.b. Response:** If a steam release occurs because a well loses mechanical integrity or a leak develops in the reinjection piping, then these would be instances of noncompliance with the UIC permit sections II.D.1, II.D.2.c and III.E.5 which require mechanical integrity and leak-free injection piping. The steam, or more specifically the hydrogen sulfide in the steam, would be an air emission and would be required to meet HDOH air standards. If the release contained reportable quantites of a hazardous or extremely hazardous substance, then PGV would have to meet reporting requirements under the Comprehensive Evaluation Response Compensation and Liability Act (CERCLA) and the Emergency Planning Community Right To Know Act (EPCRA).
- **14.c. Comment:** (109.3, 142.9, 151.5) A couple of commenters queried if PGV continues to have "mishaps," will that be sufficient to revoke this permit?
- **14.c. Response:** According to 40 CFR §144.40(a)(1), "The Director may terminate a permit during its term, or deny a permit renewal appliation for the following causes: Noncompliance by the permitee with any condition of the permit...." As to whether a "mishap" would cause the termination of the permit, EPA would have to determine if it is noncompliance with the permit and, if it were, would weigh the severity of the noncompliance.

15. Re: Upset Conditions

15.a. Comment: (85.7, 86.3, 86.5, 98.4, 122.4) A few commenters asked questions regarding upset conditions. Will more reinjection capacity be needed then the injection wells have during upset conditions? What will happen to the excess steam and brine? In an upset or worst case senario, is the Emergency Stream Release Facility (ESRF) adequate? Is it going to protect our groundwater? If PGV can't pond the brines if there's an upset of the injection wells, what do you expect them to do? Are the

ponds large enough and properly lined? Do they go through the ESRF for an extended period of time?

15.a. Response: In it's application, PGV stated that "One key feature of the PGV injection system is the ability to stop the injection of geothermal fluids into any of the injection wells by merely closing the well's valve.... To effectively manage the flow of geothermal fuids from the production well(s), the control operator diverts injectate flow to the other injection wells. In such cases, the plant operations continues by using the excess capacity which is designed into the injection wells. However, if leaks should be detected and confirmed in two injection wells, flow into these two injectors would be stopped and, if necessary, the control operator will reduce the incoming flow from the production well(s). Additionally, in the unlikely event that all of the injection wells incurred leaks or integrity failures at the same time, these injection wells would be shut in. The production well(s) would be secured or shut in by the control operator utilizing a redundant control system" (see #100834). As for production well bleed-off, PGV's writes "...in the event that there is not an operable injection well to receive production well bleed-off, PGV could either a) not conduct any bleed-off activity, or b) conduct bleed-offs through available abatement systems. Any abated well fluids would be properly stored for later disposal to an injection well or off-site in accordance with applicable regulations. Geothermal fluids from any bleed-off activity would not be disposed to the ground" (see letter #101607).

According to PGV's application material "There is no physical way for brine to go to the ESRF. Under normal operation there is no way for condensate to, nor any situation in which condensate would, go to the ESRF. During operation of the ESRF condensate is generated as part of the process of abating the gas/steam release. Under emergency situations the condensate from the steam trap condensated header can be diverted to the ESRF; however, this requires manual operation of several valves and cannot happen automatically or accidentally." (See PGV letter #101097)

The purpose of the ESRF is to remove hydrogen sulfide and minimized noise associated with emergency release of steam during certain plant upsets or during well testing (see PGV application #100795; and NEIC report #400416). The lower six feet of the ESRF is line with gunite. According to the March 1996 NEIC report, PGV estimates that the ESRF can handle about 7.8 hours of flow although the report said that PGV should document the basis for their assumptions in calculating this (see NEIC report #400417). The permit does not limit the amount of fluids going to the ESRF, other than stipulating that the fluid shall not overflow the ESRF. Fluids from the ESRF are may be injected (see PGV application #100794-100795).

- **15.b. Comment:** (56.3, 57.4, 85.6) A couple of commenters asked how can you separate UIC from ESRF from air emissions? They saw no mention of the ESRF in the UIC permit. The ESRF should have been considered as part of the injection system and its operation be conditioned by the proposed permit. In the original Authorization To Construct (ATC) Application to the DOH, the permittee made assurances that ..."to ensure the reliability of the injection system, a spare compressor, and a spare injection well will be provided. A holding pond is provided to collect liquids for the unlikely event of an upset in the liquid injection system." Permit to Operate No. P-834-1413, application for PTO P-834-1304, and permit No. A-834-796 Attachments I and II, as modified on July 17, 1992, Condition 11 states that the ESRF shall only be utilized under one or more of the following conditions: ...b) Complete upset of the geothermal injection system. Because the ESRF is apparently suppose to protect us from unabated emissions from injection well failure, the permit should include the condition to ensure reliability and proper functioning of all its parts, including the holding pond capacity. Is the ESRF covered by the proper operations and maintenance condition because they are concerned about its ability to operate.
- **15.b. Response:** An upset of the injection system could cause the ESRF to be used for steam releases. Liquids in the ESRF pond can be sent to the injection wells. So the injection wells, ESRF and air emissions are connected in that way. However, the agencies and programs that regulate the injection wells and the ESRF air emissions are separate. The ESRF air emissions and the ESRF are

covered in DOH's Noncovered Source Permit (see draft permit #102908-102932) and the Clean Air Act which states "It shall be the objective of the regulations and programs authorized under this subsection to prevent the accidental release and to minimized the consequences of any such release of any substance listed pursuant to paragraph (3) or any other extremely hazardous substance. The owners and operators of stationary sources producing, processing, handling or storing such substances have a general duty in the same manner and to the same extent as section 654, title 29 of the Undited States Code, to identify hazards which may result from such releases using appropriate hazard assessment techniques, to design and maintain a safe facility taking such steps as are necessary to prevent releases and to minimized the consequences of accidental releases which do occur...." (42. USC §122(r)(1))

As for EPA's UIC Program, EPA requires in its permit that both oral and written reports must be made to the EPA regarding "Any overflows of...the emergency steam release facility (ESRF) pond" according to Section II.E.13.d in the UIC permit. The permit contains this condition because EPA UIC Program is concerned with discharges to the ground that could potentially reach the USDW. To expressly prohibit that, a condition has been added in Section II.D.5 that states "Additionally, there shall be no overflows of fluid from the ESRF to the ground." This places the responsibility of having a properly sized holding pond on PGV. As for whether the ESRF is convered by the proper operations and maintenance condition in the UIC permit, it is insofar as it is used to achieve compliance with the UIC permit (40 CFR §144.51(e)). For instance, fluids not permitted for injection could not be placed in the ESRF.

- **15.c. Comment:** (57.8, 92.5) A couple of commenters questioned PGV's ability to quickly shut in its production wells. The rapid shut in of a geothermal well will result in a high pressure surge and thermal shock, thereby exposing the well to undesireable stresses, fracturing the well casing and causing a serious blow-out and severe hydrogen sulfide contamination. There have been incidents (KS-8 and Thermal Power wells) where rapid shut in had caused irrepairable damage to the well integrity and a hazard to the surrounding community. The complete upset of the injection system would trigger the use of the ESRF to reduce the flow rate, rather than shutting in the production wells immediately. PGV does not have sufficient injectate storage capacity to undertake a slow shut in of production wells.
- **15.c. Response:** Refer to Response 10.a regarding rapidly closing in the production wells. Refer to Response 15.a regarding PGV's inability to discharge brine to the ESRF and the capacity of the ESRF.
- **15.d. Comment:** (101.7) One commenter said that the ESRF and the sulfatreat systems are production related equipment and only related to UIC insofar as the condensate produced from their operation is pumped into reinjection. Consideration of this equipment in the permits must be limited to the disposal of that condensate.
- **15.d. Response:** The sulfatreat system which is used to treat air emissions is not covered by this permit. Overflows from the ERSF are addressed in the permit because an overflow of the ESFR circumvents the "closed-loop" injection system and enables injectate to infiltrate directly into the USDW.

16. Re: Safety

- **16.a. Comment:** (112.2, 127.2) A couple of commenters asked if they will be notified of a blowout and evaculation?
- **16.a. Response:** According to the County's GRP Condition 29, "...The Hawaii County Civil Defense Agency shall be responsible for public and media notification and evacuation of members of the public in the event the Agency deems such action necessary as a result of an emergency situation." (see GRP #100136). PGV is required under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Section 103 and/or the Emergency Planning and Community Right To Know Act (EPCRA) to notifiy the Hawaii County Local Emergency Planning Committee (LEPC), Hawaii State

Emergency Response Commission (SERC) and National Response Center (NRC) as soon as it knows that there has been a release into the environment of a reportable quantity of a hazardous or extremely hazardous substance. According to version 6.1 of PGV's Emergency Response Plan (see #102722), in the case of upsets and accidents involving geothermal steam and fluid, and spills and leaks, PGV would contact the County's Civil Defense and Planning Department, the State's Department of Land and Natural Resources, and the State DOH's Hazard Evaluation and Emergency Respose Branch, Clean Air Branch, and District Health Office under various senarios footnoted in the plan. The subsequent 6.3 version of PGV's ERP (see #102723) has the phone numbers of the agencies, but does not specify under what conditions the agencies would be contacted. In permit condition III.E.13, EPA has underscored the responsibility of contacting the LEPC, SERC, and NRC in such instances as a blowout because in the past PGV has not notified required entities (see press release #201495).

- **16.b. Comment:** (102.2, 123.2) One commenter noted that there is nothing in the permit to protect people. Another said that the governmental bodies should protect the land and citizens' health.
- **16.b. Response:** As stated in the fact sheet on the permit and collaborated in the UIC regulations, one of the intents of the permit is to protect public health and the environment, along with protecting the USDW and the injection wells. The permit itself contain conditions and requirements to meet that goal. Refer to Responses 2.b and 2.d regarding citations in the UIC regulations regarding the protection of health and the environment.
- **16.c.** Comment: (123.1) A commenter asked what EPA is going to do in a worst-case senario.
- **16.c. Response:** The worst case senario for the UIC program would be all of the injection wells losing mechanical integrity. In their contingeny plan, PGV says that they could close in the production wells if this occurs (refer to Response 15.a). It would be PGV's responsibility to shut in the injection wells so that they were not leaking and restore mechanical integrity. If PGV could not demonstrate that the wells were secured and not leaking, PGV would be in noncompliance with the UIC permit and subject to enforcement or possible termination of the permit.
- **16.e. Comment:** (101.3) One commenter wrote that there have been no incidents that have posed any health risk to local residents since the "Blowout" of KS-8 in 1991.
- **16.e. Response**: While this appears to be true for health risks associated with using the USDW, a list of incidents and newspaper articles, most involving hydrogen sulfide releases, compiled by the Kapoho Community Association appears to contradicts this statement (see list #200647-200651). Agencies that would have been involved in many of those instances and thus have more information are the DOH Clean Air Branch and County Civil Defense.

17. Re: Production wells

- **17.a. Comment:** (101.5, 108.7) PGV and another commenter wrote that UIC permits are limited to regulation of underground injection and do not include regulation of production wells or commercial operations. There should be no unnecessary constraints on production wells or plant operations.
- **17.a. Response:** The final permit references production wells in regards to conversions from non-injection wells (e.g. developmental, production, exploration) to injection wells. The permit also requires notification prior to drilling injection and non-injection wells (e.g. developmental, production, exploration) because PGV and DLNR have notified EPA that all wells, including injection wells, will be drilled as production wells. So EPA can be prepared for the likely conversion of a production well to an injection well, EPA is requiring notification prior to drilling any well. While production wells are not regulated under the UIC regulation, EPA can address problems caused by productions wells under Section 1431 of the Safe Drinking Water Act and other acts. This was demonstrated when EPA's Superfund Division

properly closed improperly abandoned production wells in the Geysers Field of California.

18. Re: Noise

18.a. Comment: (34.1, 56.4, 56.5, 57.1,76.2, 85.4, 86.1,86.2, 97.1, 97.2, 100.2, 120.10, 125.3, 127.6, 142.7) A number of people made comments on noise as it pertained to drilling, saying that it was very noisy, especially at night. In 1989 during mediation sessions, the permittee admitted that drilling noise from Well Pad E would exceed the County permit guidelines. Communication between the DOH and the County indicated that regulation and enforcement of noise is a jurisdictional battle. Who regulates noise during drilling and which standard will be enforced?

18.a. Response: It appears that the County and DLNR are responsible for noise during drilling. DLNR's Title 13, Chapter 183, Leasing and Drilling of Geothermal Resources has a section §13-183-87(i) that covers noise during drilling. "The operator of any well shall comply with all applicable federal, state, and local standards with respect to air, land, water, and noise pollution, and the disposal of liquid, solid, and gaseous effluent. Additionally, §13-183-87(b) states that "Adverse environmental impacts from geothermal-related activity shall be prevented or mitigated through enforcement of these rules and of all other applicable federal, state, and local standards, and the application of existing technology. Inability to meet these environmental standards or continued violation of environmental standards by any well operator after due notification, may be construed as grounds for the chairperson to order a suspension of well operations.

The County's Geothermal Resource Permit (GRP) states in Condition 24 (see #100132-100133) "Until such time as noise regulation are adopted by the State or County, the permittee shall comply with the following guidelines which shall be enforced by the Planning Department." During drilling, the standard is set at 55 dba during the day and 50 dba at night measured at the current nearest residence, but this may be exceeded by a maximum of 10 dba under certain conditions.

It is the jurisdiction of the County and State to set and enforce their noise standards.

18.b. Comment: (101.1) One person commented that issues such as noise regulation are unrelated to USDW protection and the UIC process.

18.b. Response: Refer to Response 18.a.

19. Re: Environmental Justice (EJ)

19.a. Comment: (157.5) While one person commented that the Puna District is not an EJ community and the geothermal development is there because the confirmed resource is there, a number of people (4.4, 85.12, 90.1, 92.6, 93.2, 94.2, 116.8, 118.2, 120.11, 142.6, 143.3, 151.6) that the area surrounding the facility is an EJ community and EPA has taken a narrow view of its EJ responsibilities regarding it. According to commenters, the 1980 census showed that the Puna District had the highest number of welfare recepients on the island and the least number of jobs. Many are senior citizens on limited income. The Big Island has the second largest percentage of Native Hawaiians (24.3% in 1990). Land is cheap in the Puna District because there few ammenities and services such as paved roads, telephone service, electricity, water lines or sewers. The issuance of this permit raises environmental justice issues that should be investigated fully before the permit becomes effective. The surrounding community has a significant minority population and a unique cultural community that are economically depressed, and are being forced to bear the burden of health and environmental risks associated with geothermal development, as well as depreciated property values. Many are too poor or sick to move away. Although the siting of geothermal power plants depends on where the geothermal resource can be found, the decision to pursue geothermal production creates a disparate and adverse impact on minority and low income populations. In Title 6 of the 1964 Civil Right Act prohibits discrimination

through federally funded programs against racial and ethinic minorities. DOH receives federal funding. The UIC permits by EPA and DOH continue this disparate impact because PGV cannot operate without them. This disparate impact constitutes a violation of Title 6 and President Clinton's 1994 Executive Order on Environmental Justice.

19.a. Response: Executive Order (EO) 12898, the Order on Environmental Justice, does not "create any right, benefit, or trust responsibility, substantive or procedural, enfforceable at law or equity by a party...." EO at 5.

The only Environmental Appeals Board (EAB) opinion which applies Executive Order 12898 to the UIC permitting process clearly states that "the Agency has no authority to deny or condition a [UIC] permit where the permittee has demonstrated full compliance with the statutory and regulatory requirements.... Accordingly, if a UIC permit applicant meets the requirements of the SDWA and UIC regulations, the Agency must issue the permit regardless of the racial or socio-economic effect of the facility on the surrounding community." In re: Envotech. L.P., UIC Apeal; Nos. 95-2 through 95-3,7 1996 UIC LEXIS 1, *45 (EAB Feb. 15, 1996).

The EAB did, however, highlight two areas of the UIC permitting scheme where the Agency has the discretion to implement EO 12898: in the public participation process and under 40 CFR 144.52(a)(9), where the Agency has broad discretion to permit conditions necessary to protect USDWs. <u>In re: Envotech, L.P.</u> at 47-49.

Title IV basically states that Federal tax funds collected from all the people may not be used to provide benfits to institutions or agencies which discriminate on the grounds of race, color, or national origin. EPA Region 9 does not have the authority to determine whether the EPA and DOH UIC permits are in violation of Title 6. That authority rests with Ann Goode, the Director of EPA's Office of Civil Rights at 401 M Street S.W., Mail Code 1205, Washington, D.C. 20460. To request a determination or file a complaint on an action, within 180 days of the action, a person must show how it resulted in discrimination or disparate impacts.

20. Re: Expertise

- **20.a. Comment:** (92.44,116.7,142.3) A couple of commenters said that EPA is giving the community highly technical material and then expecting them to respond without being trained. The community lacks the resources to hire its own independent experts to review the permit conditions and to undertake monitoring programs to ensure that the community is protected and permit conditions are enforced.
- **20.a. Response:** EPA held two informational meetings prior to the public hearing to explain and answer question regarding the draft permit and application. There were representatives from DOH and PGV at one meeting to also answer questions. On April 25, 1996, EPA facilitated a meeting between the public and an independent expert to answer questions on well abandonment and mechanical integrity testing. There are non-advocacy groups available to help communities review technical information. One such group if the Technical Outreach Services for Communities based at Stanford University.
- **20.b. Comment:** (116.2) A commenter queried who the rift zone expert is for EPA, PGV and the State of Hawaii?
- **20.b. Response:** EPA consulted with Jon Orn Bjarnason with the Icelandic equivalent of the U.S. Geological Society who is familiar with drilling on a rift zone similar to Hawaii's. We have also consulted with the U.S. BLM, the California Division of Oil, Gas, and Geothermal Resources, and the Nevada Division of Environmental Protection regarding geothermal injection well drilling and regulation. Contact PGV and the State of Hawaii directly for their rift zone experts.

21. Re: Notification and Availability of Documents

21.a. Comment: (142.1) One commenter said that regarding the public hearing, there has been misinformation in the newpapers and it was not properly noticed. The Tribune Herald and Advertiser picked it up on March 3, but the Advertiser and Tribune Herald both gave different days and different time, which totally confused everybody. Then within the last couple of days, the Trib Herald has had nothing whatsoever about this series of meetings. The Advertiser had one notice about it and it said that tonight's event started at 6:30. The commenter submitted that only 200 people showed up because of improper notice.

21.a. Response: On March 3, 1998, a public notice was published in the Hawaii Tribune Hearld and West Hawaii Today announcing the April 2 informational meeting and the April 3 DOH and EPA public hearings (see verifications of public notices #102765 & #102766-102767). That same day, a press release was also distributed to all the newspapers. The public notice (#101710-101713) and a fact sheet (#101714-101721) were mailed to the commenter and approximately 120 people on a mailing list that EPA has been compiling of people who are interested in geothermal issues (e.g. UIC, ERP, community involvement) in Puna. Both these documents included information on the April 2 informational meeting and the DOH and EPA public hearings. A second notice was sent to these people notifying them of a second informational meeting to be held on a weekend. This second notice had the right day of the public hearing (Friday), but the wrong date (April 4). So a subsequent notice with the correct date was mailed out. The 6:30 pm time refers to when the EPA public hearing was scheduled to begin. The DOH also sent out a public notice with the time and date of their public hearing in addition to EPA publisizing that information.

The newspaper articles that EPA has seen are fairly consistent and accurate. A March 4, 1998 West Hawaii Today newspaper article (see #201518-201519) stated that the informational meeting is at 5:00 pm on April 2; and on April 3, the DOH hearing is at 4:00 pm and the EPA hearing is at 6:30 pm. A March 8, 1998 Advertiser Big Island newpaper article (see #201520) had this exact same information. Additionally, an April 2, 1998 Honolulu Advertiser newpaper article (see #201555) stated that the hearings begin at 6:30 pm, which was true for the EPA hearing. People wishing to comment on the DOH authorization to construct and permit renewal could do so at the EPA hearing.

- **21.b. Comment:** (142.2) One person commented that it was only yesterday, April 2, that the thick documents, including the draft permits, appeared here at the informational meeting and appeared in our library. No one in this community has really had a chance to go through that material and go through it well.
- 21.b. Response: On March 3, 1997, thirty days before the public hearing and forty-five days before the close of the first public comment period, the following occurred: a public notice (#101710-101713) which was published in two papers, a press release was made available to newspapers, and a fact sheet (#101714-101721) and public notice that were mailed out to approximately 120 people including the commenter. These documents notified people that they could obtain a copy of the draft permit and PGV's application by writing, faxing, electronically-mailing or calling EPA. These documents also stated that the public could also access the draft permit at EPA's webpage address. The public notice and fact sheet also notified people that the draft permit, application, fact sheet, and public notice were available for examination at the Pahoa Public Library, Keaau Public Library, Hilo Public Library, University of Hawaii at Hilo Library and the EPA Pacific Island Contact Office in Honolulu. Those documents were mailed to the libraries and EPA PICO office about one week after the public notice. EPA also made the forementioned documents available to the public at both informational meetings and at the public hearing. During the second 60-day public comment period, a copy of the administrative record for the draft permit was available at the Pahoa Public Library. Information regarding the reopening of the public comment period was published in the Hawaii Tribune Herald and West Hawaii Today, and was mailed to the public (see press release #102769-102770 & public notice #102787). EPA reopened the public

comment period, in part, to enable the public to review and base their comments on the administrative record.

22. Re: Permit Organization

- **22.a. Comment:** (108.1) PGV made the comment that it appears that little effort went into organizing the EPA permit to eliminate duplication, overlapping requirements, and redundancies. PGV urges EPA to review its final permit in detail so that requirement are only mentioned once.
- **22.a. Response:** In the final permit, EPA made an effort to eliminate redundant conditions and combine similar conditions. Where conditions are combined or eliminated because of redundancy, it is noted in the response to comments under the specific permit condition. In some instances, it is necessary to address topics twice because the regulations under 40 CFR §144.51 require that certain conditions shall be incorporated into permits either expressly or by reference. These conditions are in Part III, General Permit Conditions. In Part II, Specific Permit Condition, the specific conditions are covered in greater detail, thus creating some necessary repetition. Because EPA is requiring exactly the same monitoring as DOH, this should not be confusing to plant employees who have been carrying out that monitoring for years. Some of the redundancy in the draft permit was created at the request of PGV. In its May 22, 1997 comments, PGV requested that all reporting requirement be placed in one section of the permit to form a checklist. EPA created that checklist, while also leaving the of the monitoring/reporting requirements in the sections that pertain to them where they are discussed in more detail.

23. Re: Permit Wording

- **23.a. Comment:** (108.23) PGV commented that all references to "reinjection" in the permit should be changed to "injection." Reinjection incorrectly implies that the geothermal fluids have previously been injected.
- **23.a. Response:** EPA used the word "reinjection" in the draft permit because PGV's application material makes reference to the "combined brine reinjection line", "combined reinjection flowline", "reinjection common header", "condensate reinjection header", "reinjection wells" and "reinjectate" (see PGV application and letter #100792, #100794 & #101096). PGV's May 22, 1997 comments on an earlier draft permit state that "injectant line" should be "combined re-injection line" and that "Throughout the permit, `reinjection' should read as `re-injection'" (see PGV's comments #101458). The terms "reinjection", "re-inject", and "reinjection well" have also been used by county and state agencies (see Hawaii County memorandum #200383; DLNR memorandum #102667-102669; and DOH memorandums #102699-102701 & #102702). However, the current trend is to use "injection" rather than "reinjection" and the final permit reflects this.

24. Re: Permit Consistency

- **24.a. Comment:** (108.25) PGV commented that in the final permit, EPA's and DOH's reporting requirments and permit conditions should be consistent to avoid confusion to those implementing them. Native Lands Institute (92.7, 93.4) also commented that state and federal draft permits are not identical and seem to depend on one another for key elements. They went on to say that the term of the permit is too long. Because the two permits are so interdependent, they should require renewal at the same and the federal permit should be for five years rather than ten.
- **24.a. Response:** DOH and EPA have worked to make the two permits consistent. EPA's permit does refer to DOH's monitoring plan, however, this has been modified so EPA's permit can stand alone. Changing the duration of EPA's permit to five years would make the state and federal permits consistant in terms of the number of new wells allowed and the renewal period. This will also address PGV's

comment that it has "consistently stated, different requirements on the same subjects in the federal and state permits will be unduly burdensome and confusing for PGV and may lead to wholly-unintentional permit reporting lapses...it is incumbent upon EPA to ensure that its permit conditions and reporting requirements are consistent with those of DOH...." In response to the Native Lands Institute's request and PGV's request for consistency, EPA is changing the term of the permit to five years.

- **24.b.** Comment: One commenter said they hoped EPA uses the same standards that are used for other geothermal wells located in the United States.
- **24.b. Response:** While drafting the permit, EPA examined UIC permits for injection wells in Hawaii, California, and Nevada. EPA also consulted with the California Division of Oil, Gas, and Geothermal Resources, which regulates geothermal wells on state lands in California, and the U.S. Bureau of Land Management, which regulates geothermal wells on federal lands in California. All geothermal permits have similarities, such as requiring that the wells maintain mechanical integrity. However, because of differing circumstances, such as hydrogeology, each permit is slightly different (see 40 CFR §§144.52 (a)(9) which states that "EPA may impose on a case-by-case basis such additional conditions as are necessary to prevent the migration of fluids into USDWs").

25. Re: Permit Changes and Condition Waivers

- **25.a. Comment:** (57.2) One commenter said that permit conditions are subject to administrative change without public review and such changes have not always been in the interest of the community.
- **25.a. Response:** Other than the minor permit modifications listed in 40 CFR §144.41, all other permit modifications according to §144.39 require drafting a new permit with public review and comment on the modifications and the option of a public hearing.
- **25.b.** Comment: (56.2) One person objected to conditions that allow waivers (e.g. waive reporting), because they thought there needed to be written reports in the EPA permit.
- **25.b. Response:** There are no waivers in the EPA permit.

26. Re: Administrative Record

- **26.a. Comment:** (31.1, 150.1) PGV requested that certain documents be added to the administrative record, because they did not see those documents when they reviewed the files in the EPA office on March 11 and 12, 1998. PGV also requested that its June 23, 1998 comments on DOH's permit renewal and proposed Authorization To Construct become part of the administrative record as comments on EPA's permit and DOH's permit.
- **26.a. Response:** When PGV representatives visited the EPA office to review the administrative record of the draft permit, these documents, with the exception of one, were being copied in response to a Freedom of Information Act request that PGV had filed (see electronic mail #102779; and note #102781). The documents in question are located in the administrative record at #100970-101007, #101063-101072, #101073-101074, #101075-101081, #101095-101097, #101110, #101106, #101141-101147, #101178-101184, #101148-101150, and #101495. EPA does not have a copy of, nor does EPA recall seeing, PGV's agenda for the October 25, 1996 meeting, which has the notation "This agenda and topics list is for use by the PGV representatives." Because it was submitted during the public comment period, it will become part of the administrative record. As for PGV's comments on DOH's permit, they are part of the administrative record on the EPA permit because they were submitted with PGV's comments on the EPA permit. The comments on the DOH permit are not addressed in this response to comments on the draft EPA permit because the comments are specific to the DOH permit.

Specific Comments

27. Re: Application

- **27.a. Comment:** (122.1) One commentor asked why KS-4 and KS-8 aren't on the page C-4 diagram in PGV's application and requested that EPA obtain that information.
- **27.a. Response:** Because of a claim of confidentiality, KS-8 is not listed on page C-4. However, KS-8 is on a October 20, 1991 temperature cross-section (see # 100301). PGV supplied a cross-section that included KS-4 in its comments on the draft permit (see July 20, 1998 Comments of Puna Geothermal Venture on the U.S. Environmental Protection Agency's Draft Class V individual Permit No. HI596002, Attachment 5).

28. Re: Jurisdiction and Authorization to Operate (I)

- **28.a. Comment:** (108.26) PGV made the comment that the permit should be issued in the name of the project owner--Puna Geothermal Venture. The Operator should not be listed in the permit.
- **28.a Response:** Under 40 CFR §144.25(b), the EPA may require an owner or operatior of any well which is authorized by rule to apply for a permit. The EPA permit is issued to the owner and operator which is consistent with DOH's permit.

29. Re: Proposed Injection well Locations (II.A.2)

- **29.a. Comment:** (108.27) PGV commented that if an individual permit is required, it should be issued for an additional nine (9) new wells, at a minimum, not the seven (7) new wells authorized in the draft permit.
- **29.a. Response:** On April 3, 1998, PGV requested nine new wells from EPA, in addition to requesting an area permit for an unspecified number of wells. That previous August, PGV had requested seven new wells from the DOH. To be consistent with the DOH permit, EPA will grant seven new wells and modify the duration of the federal permit to five years. (Refer to Response 24.a regarding PGV's request for consistency with the DOH permit.)
- **29.b.** Comment: (162.1) The comment was made that the locations of the existing and proposed injection wells are not shown in Appendix B.
- 29.b. Response: The location of the existing injections wells shown on the map in Appendix B of the draft permit, but not the location of the proposed wells. Initially, PGV applied for an area permit for an unspecifed number of wells and did not identify the location of the new wells except that they would be in the property boundary (see PGV application #100717-100718, #101726 & #101154). EPA asked PGV to provide the location and number of new wells needed. On January 15, 1997, PGV provided a map of existing and proposed well pad locations where new injection wells may be drilled (see #101178-101183). However, PGV still wanted to drill anywhere within the property boundary and did not intend the map to lock them into exisitng and proposed well pad locations (see letters #101557-101559 & #101178; and record of communication #101487). As for the number of new wells, PGV insisted on an area permit for an unspecified number of wells, but said that they would need anywhere from a total of 7 to 32 new wells (see record of communication #101618; and letter #101636-101637). At the time the draft permit was issued, PGV had not provided EPA with the number of new wells needed. In order to be consistent with DOH and at the request of PGV for consistency (see Response 24.a), EPA decided to be consistant with DOH's draft Permit To Construct in which PGV has applied for seven new wells. A total of ten injection wells is also consistent with number of wells that PGV informed EPA was needed (see letters #101180 & #101556; and PGV's comments #1011451 & #101454). As for the location of the

new wells, EPA conditioned the draft permit on PGV, 120 days prior to the planned spudding of an injection well, providing EPA with the latitude and longitude of a new wells and a map similar to the one in Appendix B with the location of the existing and proposed wells.

At the public hearing on April 3, 1998, PGV provided EPA with a letter requesting nine new wells and a map providing the location of the existing and proposed well pad locations. Based on this information, EPA will modify the permit to replace the map in Appendix B with the map of the existing and proposed well pad locations. EPA will still require notification, seven days prior to spudding a new injection well, of 1) the well pad and latitude and longitude of the new well, and 2) a map indicating the location of the existing wells and the new well.

As for the conversion of a production well to an injection well, EPA will no longer require 120 days notification prior to the conversion because PGV has provided a map with the proposed well pad locations. The permit wiill clarify that the well that is being converted to an injection well needs to be located on an existing or proposed well pad or EPA will not approve the conversion. EPA was going to use the 120-day time period to request and examine information necessary for the conversion approval process. However, to streamline the process, EPA will modify the permit to specify the information that PGV shall supply for the conversion approval process. EPA will require the following: well schematic similar to the ones in Appendix A; drillers logs; lithologic logs; a demonstration of internal and external mechanical integrity which could include temperature logs, pressure tests, cement bond logs; and injectivity/ pump test results. Once this information is provided, EPA will consider it and notify PGV of it's decision regarding conversion approval.

30. Re: Injection Well Setback (Under Proposed Injection Well Locations, II.A.2)

- **30.a. Comment:** (92.9, 116.4) A couple of commenters questioned the 600-foot setback. They thought the setback should be at least 1,500 feet or more from the property boundary because of the dangers posed by drilling new injection wells and the close proximity of residences and farms.
- **30.a.** Response: A 600-foot setback was chosen to be consistent with existing 600-foot setback required by DOH's Draft 98-A Noncovered Source permit (condition IIB.B.4) which PGV recognizes (see record of communication #101487). DLNR has a 100-foot setback requirement (see Rules on Leasing and Drilling of Geothermal Resources, §13-183-69), but EPA chose DOH's and the County's as being more protective.
- **30.b. Comment:** (108.28) PGV commented that there is no justification or explanation for the 600-foot setback. It is not found in the UIC regulations nor does bear any relationship to protection USDWs.
- **30.b.** Response: Refer to Response 30.a. The UIC regulations do not specifically cite a 600-foot setback, but 40 CFR §144.52(b)(1) states that "In addition to conditions required in all permits the Director shall establish conditions in a permits as required on a case-by-case basis, to provide for and assure compliance with all applicable requirements of the SDWA and parts 144, 145, 146 and 124." This includes §144.12(d) which states "Whenever the Director learns that a Class V well may be otherwise adversely affecting the health of persons, he or she may prescribe such actions as may be necessary to prevent the adverse effect, including any action authorized under paragraph (c) of this section." So on a case-by-case basis, permit conditions shall be established to prevent Class V wells from adversely affecting the health of persons. There are homes adjacent to PGV's property line. Given that injection wells can blow out (KS-8 is an example of this), the setback is designed to prevent such incidences from adversely affecting the health of persons.
- **30.c. Comment:** (162.2) One commenter wrote that the required EPA set-back for the proposed injection wells (600 feet) from the PGV property boundary should be established in conjunction with existing regulatory set-back requirements of the County of Hawaii's Geothermal Resource Permit (GRP).

Appropriate recognition of existing County regulations which limits the developer to construct wells on designated well pads should avoid conflicting set-back requirements.

30.d. Response: According to a map supplied by PGV (see #101183), the existing and proposed well pads appear at least 600 feet from the property line, with the exception of the western part of Well Pad E. By following the County's requirement to drill only on designated well pads, PGV will also be in compliance with this 600-foot setback requirement, with the exception of the western part of Well Pad E. EPA recognizes the County's requirement which limits drilling to designated well pads and final permit Condition II.A.2 has been modified to reflect this.

31. Re: Pre-drilling Notice and Approval Requirements (Under Proposed Well Locations, II.A.2)

31.a. Comment: (108.29) PGV commented that in order to initiate the approval process for any new injection well(s), PGV must provide EPA with information 120 days prior to planned spudding of (or conversion to) an injection well. A public hearing would also be held on each new well. First of all, wells are typically drilled as production wells (see Memorandum from John C. Levin [sic] to William W. Patty, Sept. 24, 1991) then considered for use as injection wells. At that time, of course, it is too late to change it location. Second, the 120-day time period and demonstration of actual need is unreasonable, and EPA doesn't set forth criteria for approval of the location of new wells.

31.a. Response: At the time the draft permit was issued, PGV had not provided EPA with an exact number of new injection wells, nor their locations (refer to Response 29.b). In response to a request from EPA, PGV had provided a map with existing and potential well pad locations, but a subsequent letter from PGV to EPA stipulated that "...at EPA's request...PGV submitted a site map showing the location of prospective/possible well pads on which future wells might be placed. However, PGV did not intend for this map to be used by EPA for purposes of restricting the authorized 'area'" where new wells could be drilled (see #101559).

So EPA could move forward with issuing the draft permit, EPA drafted the new well approval process to take into account the lack of information on the exact number and location of new injection wells. This new well approval process was similar to adding a new well to the permit which is a major permit modification under §144.39 and would be open to public review and comments, and a public hearing would be held if there was significant interest. The criteria that would be used to approve new wells is that which is stated in the permit (e.g demonstration of mechanical integrity, financial assurance for plugging and abandonment, etc.).

On April 3, 1998, the night of the public hearing on the draft permit, PGV submitted a request for nine new wells. This request contained information requested by EPA, specifically the number and well pad locations of new wells. Having received this information, EPA is removing the new well approval process that was incorporated into the draft permit to address an unknown number of new wells with unknown locations. Because EPA now knows how the number and location of the new wells, the permit will be modified to remove the requirement of providing documentation of actual need. EPA will still require the latitude and longitude of every new well and an updated version of the map in Appendix B indicating the well pad location of where a new well will be located prior to spudding a new injection well or converting a well to an injection well. The location of each new well is basic information required for every EPA permit application under 40 CFR §144.31(e)(2) which requires the location of the facility, facility being defined as "any UIC `injection well'" in §144.3.

Regarding the statement that wells are typically drilled as production wells, the September 24, 1991 memorandum from John Lewin, Deputy Director of DOH, to William Patty, Chairperson of DLNR (see memorandum #102699-102701), requests that the construction of all geothermal wells, regardless of the various geothermal well classifications such as production, monitoring and reinjection, be subject to DLNR's permit, while DOH's permit would govern operation of injection wells. This memorandum does

not suggest that all wells be drilled as production wells, but rather that "the purview of [DLNR's] geothermal well construction permit be expanded to include geothermal reinjection wells." The memorandum also requested that a letter be sent to document the cooperative efforts. A March 2, 1993 Memorandum of Agreement (MOA) was drafted between DLNR and DOH documenting the responsibilities of each agency (see draft MOA #102703-102708). While a final version of this document could not be produced at an April 1, 1997 meeting between EPA, DLNR and DOH, the March 2, 1992 draft indicates that DLNR is responsible for the design, drilling and abandonment of injection wells, while DOH is responsible for their operation. This echos a September 21, 1992 memorandum from John C. Lewin to William W. Paty which states that "I would like to reiterate our understanding that all geothermal wells, whether production wells or reinjection wells, shall be constructed to the standards of a production well." (See memorandum #102702). The intent is to "construct all geothermal wells to production well standards [which] will allow for flexibility of use", but none of these memorandums nor MOAs state that all wells will be drilled as production wells.

While drilling and testing ultimately determine whether a well will be an injection or a production well, it appears that KS-5 is intended to be an injection well based on communication with Hiram Young of DLNR (see record of communication #200618) and the application for a permit to drill in PGV's application (see #100798-100827) which was provided as a generic well construction plan. The application states that "The well will be drilled for the purpose of providing additional injection capacity for the disposal of spent geothermal fluid and gases from the PGV 25 MW power plan.... The target is expected to be in fractured basalt with relatively low permeability and will provide injection capacity similar to that of KS-1A, KS-3, and KS-4." (See PGV application #100800) The plan calls for drilling until an injection zone is found, conducting an injectivity test and hanging a perforated liner.

PGV commented that it is too late to change the location of a well once it is drilled. Because of that and the uncertainty of whether a well will be a production or injection well, it is important that a new wells meets the requirements of both production and injection wells, including setback distance and well pad location. If a production well that is being converted to an injection well does not meet injection well requirements, it will not receive approval to be used as an injection well.

32. Re: Emergency Response Plans (Under Proposed Injection Well Locations, II.A.2)

32.a. Comment: (6.2, 68.1, 78.2, 79.5, 92.3, 113.2, 120.8, 127.7, 138.1, 144.3) A number of commenters said that should an emergency event occur during drilling, there needs to be an emergency response/evacuation plan. There's a lack of communication of the part of PGV with Civil Defense, the Fire Department, the Police Department and the community. Some said that there is no emergency response plan in place to protect those living near the plant. Another commenter (59.3) wanted to know more about the review of the emergency response plans.

32.a. Response: PGV and the County each have an emergency response plans. These have been reviewed by independent experts and assessed in EPA's Emergency Response Plan (ERP) Review, which has gone out for public comment (see draft report #401116-401431). To address the concern of issuing a permit before we know how complete the ERPs are and because most evacuations and emergencies have occurred during drilling, EPA has added Condition II.A.2. This condition states that the approval of a new well or wells will not be given prior to sixty days following the close of the public comment period on EPA's review report of PGV's ERP and the County's Emergency Operations Plan (EOP). The close of the 60 day period fall on July 30, 1999. The draft permit stated that approval of new wells would be conditioned on the adequacy of PGV's plan. Because adequacy is difficult to judge, EPA is changing the language of the permit to completeness of the plans rather than adequacy. The importance of having a complete emergency response plan in place prior to drilling is reflected in one toxicologist's comments on the ERP review, "Given PGV's history of problems during drilling (both major blowouts occurred during previous drilling), EPA should consider permitting, inspection and/or enforcement options to very strongly encourage implementation of the report's recommendations prior to

future drilling at the site. With all of the deficiencies noted in the report, and the <u>serious</u> implications for potential risks to worker and public health, it does not seem prudent to allow PGV to drill additional wells until adequate emergency response planning and preparations are in place to protect workers at PGV and residents in the surrounding community." (See memorandum #102794-102796).

Part II.B.1.e recommends that PGV notify the emergency responders (e.g. County Civil Defense, Fire Department, Police Department) prior to the construction of any new injection or non-injection (e.g. developmental, production, exploration) well so that these entities will be better prepared to respond to emergencies that may arise during drilling which could endanger human health and the environment, including the USDW. Better communication between PGV and the emergency responders is an issue that was raised during the review of the the ERPs (see draft report #401116-401431; and memo #102794-102796).

While EPA reviewed the County's EOP, the drilling of new wells will not be contingent on it for the reasons stated in Response 32.e.

- **32.b.** Comment: (120.9, 144.2) Two commenters said that it is essential that PGV not be allowed to increase its production capacity until it has the ability to assure a satisfactory emergency response.
- **32.b. Response:** EPA does not regulate production capacity. However, it is important that PGV and the County have complete ERPs prior to drilling new injection wells. That is why we have included conditon II.A.2 which is described in the previous response.
- **32.c. Comment:** (85.2, 92.12, 98.3, 116.5) A few people commented that the operation of the existing wells should be conditioned on the adequacy of PGV's Emergency Response Plan and the County of Hawaii's Emergency Operations Plan. The absence of adequate plans to respond to emergencies creates a disparate impact on the residents of Puna, especially those who live closest to PGV's operations.
- **32.c. Response:** In the past, most of the problems that have activated the ERPs have occurred during drilling and venting. EPA is not aware of any problems that have occurred during normal injection operations that have activated the ERPs. Therefore, the final permit does not require the operation of the existing injection wells to be subject to Condition II.A.2. PGV's existing injection wells are currently authorized by rule until a permit is issued or denied according to §144.31(a).
- **32.d. Comment:** (49.2, 108.30) PGV and the County opposed the inclusion of the Condition II.A.2, which states that approval of new wells will not be given prior to the 60 day following the close of the public comment period on EPA's review report of PGV's Emergency Response Plan and the County of Hawaii's Emergency Operations Plan since that is the responsibility of the County of Hawaii.
- **32.d. Response:** The Hawaii County Planning Department is responsible for approving PGV's ERP, and the Hawaii State Civil Defense Agency is responsible for approving the County's plan. For this reason and because PGV does not have jurisdiction over the County's plan, EPA has deleted the County of Hawaii's ERP from the permit. EPA has worked cooperatively with the County and PGV to have independent experts assess the ERPs. The 60 days gives EPA time to assess the public comments on EPA's ERP review for new information. Based on the findings of EPA's review and public comments on those findings, EPA will work cooperatively with PGV, the County, and other stakeholders to address issues and the completeness of the emergency response plans. Refer to Response 32.e. regarding what EPA can and cannot do and how the permit has been modified because of this.
- **32.e. Comment:** (108.30) PGV commented that the delayed ERP review, most of which is irrelevant to USDW protection, should not form the basis for requiring an additional waiting period for the drilling of new wells. PGV should not be expected to delay its operations because of what EPA's ERP review

panel or the County does or does not do. EPA has no jurisdiction to review the adequacy of the ERP's and has no authority to compel PGV to make changes in its ERP. The permit already contains provisions for dealing with protection of groundwater in the event of upset conditions.

32.e. Response: The ERPs are relevant to injection wells because an incident such as a blow out can impact the USDW by direct contamination or by fracturing the confining layer between the USDW and the blowout, and may adversely affect the health of persons. As stated in 40 CFR §144.52(b)(1), "In addition to conditions required in all permits the Director shall establish conditions in a permit as required on a case-by-case basis, to provide for and assure compliance with all applicable requirements of the SDWA and parts 144, 145, 146 and 124." This includes §144.12(d) which states "Whenever the Director learns that a Class V well may be otherwise adversely affecting the health of persons, he or she may prescribe such actions as may be necessary to prevent the adverse effect, including any action authorized under paragraph (c) of this section." Accordingly, permit conditions shall be established to prevent Class V wells from adversely affecting the health of persons. The 60 days following the close of the public comment period gives EPA time to assess any new information in the public comments regarding potential adverse health affects from drilling a new injection well and the ability of the ERPs to mitigate these effects. The public comment period on EPA's review of the ERPs began on February 19, 1999 and closes on May 31, 1999. The 60-day UIC assessment of the public comments closes on July 30, 1999.

Upon request, EPA, which is the agency responsible for enforcing the Emergency Planning and Community Right-to-Know Act, will review and comment on state or local ERPs. The National Contingency Plan (40 CFR §300.415(b)(2)) authorizes EPA to consider emergency response actions at those sites that pose an imminent threat to human health or the environment (see preliminary assessment #400069). While EPA can review ERPs, EPA agrees that it cannot make PGV and the County modify to their ERPs. This is why the term "adequate" has been removed from the permit. Because PGV cannot make the County correct any deficiencies in the County's Emergency Operations Plans, the condition involving the County's plans is not in the final permit. While EPA cannot make PGV correct deficiencies in its own ERP, PGV has the ability to remedy those deficiencies. Thus, the approval of new wells is contingent on the completeness of PGV's ERP. Criteria for completeness are contained in EPA's review of the ERPS (see report #401116-401431).

The section on upset conditions in the permit only deals with an upset of facility operations where the injection wells cannot be used. It stipulates that brine will not be disposed of on the ground and it directs PGV to notify appropriate agencies. It doesn't address the response to problems that may occur during drilling or a loss of mechanical integrity that cannot be mitigated immediately.

32.f. Note: The paragraph regarding emergency response plans has been move to II.B.1., New Wells and Conversions.

33. Re: Well Construction And Related Conditions (II.B)

- **33.a. Comments:** II.B.1-3. (92.13) Native Lands Institute commented that they have serious doubts about the expertise of PGV to sufficiently protect USDWs in this particular geological setting using their proposed technology and processes.
- **33.a. Response:** The casing and cementing, tubing and injection intervals of PGV's generic drilling plan are designed to protect the USDW. Bob Verity, an drilling expert who was hired to advise on wells KS-9, KS-10 and KS-4, drilled those wells drilled safely. EPA does not know who the drilling consultant will be on PGV's next injection well, but will add language to the permit that this individual and the rest of the drilling crew should have drilling expertise.
- 33.b. Note: A new section labeled "New Wells and Conversions" was added under II.B.1 which

combines the requirements for new wells and non-injection wells being coverted to injection wells. Section II.B.1.a contains a new condition requiring PGV to notify EPA at least fourteen days prior to the drilling of any new injection well or non-injection (e.g. developmental, production, exploration) well. Any well drilled through USDW into the deeper geothermal reservoir presents a conduit for geothermal fluids to migrate into the USDW if that well is not properly drilled, cased, and cemented. This notification enables EPA to be in contact with PGV and DLNR in order to determine whether there is an endangerment to the USDW. Additionally, PGV and DLNR have notified EPA that all new injection wells will be drilled as production wells. In the likely event that a production well is converted to an injection well, this notification enables EPA to prepare for the conversion process. This section also contains the recommendation that PGV notify the emergency responders (e.g. County Civil Defense, Fire Department, Police Department) prior to drilling any new injection or production well. The need for better communication between PGV and the emergency responders was highlighted in EPA's review of PGV's and the County's emergency response plans.

34. Re: Casing and Cementing (II.B.1)

- **34.a. Comment:** (108.31) PGV commented that the second sentence in the section should include an additional provision to allow changes to the construction plans after notification to the EPA. This provision is necessary because of the expected development of new technology and the natural evolution of procedural improvements which should be incorporated without the delays associated with permit modifications.
- **34.a. Response:** EPA will modify this section to allow changes to the construction plans following notification to and approval by EPA. This is consistent with 40 CFR §144.52(a)(1) "Changes in construction plans during construction may be approved by the Administrator as minor modifications (§144.41). No such changes may be physically incorporated into construction of the well prior to approval of the modification by the Director."

35. Re: Tubing (II.B.2)

- **35.a. Comment:** (108.24) PGV commented that the gas/fluid interface and the base of the USDW are not consistent for all wells. Accordingly, it is inappropriate to specify 2,000 feet uniformly. PGV suggest that all provisions of the permit which specify the gas/brine interface at "2,000 feet," should be changed to "the base of the USDW." This protects the USDW but recognizes that the base of the USDW is not always located at the 2,000 foot depth. A static temperature log could be used to determine the depth of the base of the USDW.
- **35.a. Response:** The condition cited above was developed on April 25, 1996 when PGV, DOH, DLNR, and EPA met to improve PGV's mechanical integrity testing program (see letters #201138-201139 & #201140-201142). This was prompted by a review of PGV's MITs that was conducted by the U.S. Bureau of Land Management for the EPA (see review #200952-200969 & memorandum #201126-201129). During the meeting, PGV presented the base of the "`groundwater' aquifer" being at approximately 2,000 feet (see notes #200745-200747). This is consistent with PGV's application which states "The potential USDW is defined in this context as consisting of the uppermost aquifer(s) existing from the water table at approximately 580 feet below ground surface (bgs) to the `confining' zone at approximately 2,000 feet bgs" (see #100895). The BLM proposed that PGV depress the nitrogen/brine interface in the annulus to 2,500 feet to give the facility some leeway should a problem occur (see letters #201138-201139 & #201140-201142). PGV maintained that they would be able to keep the brine/gas interface at 2,000 feet. This was later incorporated in PGV's Casing Monitoring Program which is part of DOH's Permit to Operate. The Casing Monitoring Program has been incorporated in EPA's draft permit with a couple of additions (see draft permit #101730-101731 & #101759-101765).

While EPA acknowledges that the base of the USDW may not be at exactly 2,000 feet for every well,

EPA is using the information that PGV supplied at the April 25, 1996 meeting and in its application. The July 29, 1996 Program for Mechanical Integrity Testing and Monitoring of Injection Wells, which was submitted as part of PGV's application (see #100887), states that "The purpose of these revisions (to the original PGV Program for Mechanical Integrity Testing and Monitoring of Injection Wells) is to better accomplish the goal of protecting the groundwater aquifer under the PGV project site, which is considered to be a USDW. The principle changes in the monitoring and testing procedures are as follows: As described in Section 3.1 of this TMP for wells in injection service, the annulus nitrogen pressure will be maintained to keep the nitrogen/water interface at a depth of at least 2000 ft." EPA's permit will continue to require PGV to depress the nitrogen/brine interface to 2,000 feet and monitor the nitrogen pressure in the annulus of each injection well as proposed in its application. This type of monitoring was successful in detecting the leak in the tubing of KS-3 on February 27, 1998 (see record of communication #101688; see letters #102762 & #102797-102799). Had it not been for this type of testing, the leak might not have been discovered until months later when PGV ran their annual MITs.

As for using a static temperature log to determine the base of the USDW, this log will indicate temperature with depth. Changes in temperature gradient can used to infer relative formation permeability. However, the total dissolved solids (TDS) concentration of groundwater, which is used to determine the presence of a USDW, cannot be determine from a static temperature log. That is determined by actual groundwater sampling or possibly by using a conductivity/resistivity probe with a temperature probe for temperature corrections.

A similar comment questioning the base of the USDW is raised in the USDW section (refer to Comment and Response 8.d).

- **35.b. Comment:** (162.3) One agency commented on the following statement: "The casing/tubing annulus of all existing and proposed injection wells with be filled with nitrogen gas down to a depth of at least 2,000 feet." The permit should not limit the applicant to the above, but should allow the applicant the flexibility of having other means of monitoring the integrity of the well casing for the protection of the ground water. Our understanding is that in other well fields, the use of a casing inspection program which use a UT (trade name for ultrasonic) inspection survey to verify casing thickness as an annual Mechanical Integrity Testing (MIT) requirements is being used. This type of inspection should not be ruled out as an option for the applicant.
- **35.b.** Response: EPA is open to PGV using other logs, such as an ultrasonic electric log for their annual internal MITs. However, EPA was informed by DLNR on January 8, 1999, that the ultrasonic logs don't work with high temperatures and may not be appropriate for these wells. The permit can be modified to allow PGV to use other logs for their injection well MITs once PGV has submitted satisfactory documentation showing that the new logs yield equivalent information. The Casing Monitoring Program does not preclude PGV from conducting any additional testing using other logs, as long as the MITs in the current Casing Monitoring Program are performed.

36. Re: Injection Intervals (II.B.3)

- **36.a. Comment:** (108.33) PGV commented that in the second sentence, for clarity as to when this form applies, the term "rework" should be used in lieu of the term "alteration." "Rework" should be defined in this permit as "involving mechanical change in the well, not including normal maintenance activities."
- **36.a. Response:** The wording in question "Alteration of the injection perforations and other rework operations..." implies that the alteration of injection perforations is a rework operation. DOH's Draft 98-A Noncovered Source Permit contains the following definition "Reworking' is meant to include recompletion of a well; deepening or redrilling (side-tracking) of a well; or other repairs, maintenance or modifications below the casing head. Such activities commonly involve a drilling rig." The final permit

includes a modifed version of this definition in the Appendix J glossary (see #103046). PGV can use that definition as a guideline.

37. Re: Monitoring Devices (II.B.4)

- **37.a. Comment:** (108.34) PGV commented that a general provision must be inserted to recognize that it is possible that a monitoring device may malfunction or that the computer software controlling a particular device may go down. As currently written, the permit would not allow PGV to operate the facility under such circumstances and PGV would have to shut down or operate in violation of the permit.
- **37.a. Response:** There is no condition in the permit that requires PGV to shut the facility down if a monitoring device is inoperable. If a monitoring device is not working, PGV will be in noncompliance with the requirement that it maintains the monitoring devices in accurate and good operating condition, and should bring the monitoring device back into operation as quickly as possible, in addition to reporting the noncompliance.
- **37.b. Comment:** (92.14) II.B.4.b-g. Native Lands Institute commented that the readings of the continuously recording monitoring devices should be delivered electronically to the DOH and/or EPA and to Puna Malama Pono as well as the control room at PGV in real time so as to ensure accurate reporting to the agencies and prompt response to violations and emergencies. According to community records over the past five years, PGV has a history of inaccurate and untimely reporting of toxic leaks and accidents.
- **37.b. Response:** The continously-recording devices for the injection wells are: 1) a gauge and graphical chart for the injection pressure, 2) a gauge and graphical chart for annular nitrogen pressure, 3) a gauge and graphical chart for temperature, and 4) a flow totalizer. Only injection pressure and flow data at the wells are sent to the contol room (see letters #100972 & #101096). The gauges and strip charts are checked several times daily (Bob Verity, personnel communication, April 25, 1996). According to PGV's application material (see letter #101096), the control room can also receive electronic data taken at the combined brine reinjection line on: 1) pressure which has a switch that triggers visual and audible alarms in the control room as well as a computer printout; 2) flow from an ultrasonic flow transmitter; and 3) temperature.

According to PGV (see letters #100972 & #101096), there is a pressure switch on the (combined re)injection line that will trip and automatically reduce pressure to the injection wells if the pressure reaches 470 psig. This also activates relief valves set at 500 psig on the individual injection lines. The maximum injection pressure limitation in the permit is 500 psig and this is well below the pressure that the wells were tested to or calcuated to withstand (see PGV application #100771-100778).

As for the nitrogen pressure, the leak in the tubing of KS-3 was discovered within three to four hours after it occurred (see letters #102762 & #102797-102799). This was reported to DOH within eight hours of the discovery of the leak (see record of communication #101688).

Given the safety mechanism for the injection pressure and the prompt reporting of the KS-3 tubing leak, EPA believes that it is not necessary to receive real time data for these and the other parameters. PGV is required by the permit to keep the strip charts until three years after the well has been plugged and abandoned (see draft permit #101736). EPA can access this information and it is public information according to 40 CFR §144.5(b)(2).

37.c. Comment: (108.35) II.B.4.b. PGV commented that this section is written in a confusing manner and does not accurately describe the monitoring devices currently utilized by PGV. The following language is suggested: "(b)(i) a continuously recording injection wellhead pressure recorder (gauge and

graphical chart) on the injection line immediately upstream of the wellhead of each well; (ii) a remote pressure transmitter on the combined injection line, that provides information directly to the control room: and (iii) an injection pressure switch that triggers a computer printout in the control room." Injection pressure just refers to pressure at the wellhead and cannot be used for the combined line which receives more than just brine. A remote device that transmits readings is a transmitter. The injection pressure switch currently employed by PGV triggers a computer printout. The computer terminal is directly adjacent to the operator's control panel in the control room and the mere operation of the terminal visually and audibly alerts the operator. No additional visual or audible alarms are necessary or appropriate.

- **37.c. Response:** EPA will make most of the suggested change in language for clarity. For clarification, the final permit contains language from PGV's application material (see letter #101096) distinguishing between the overpressurization switch set at 470 psig on the combined flow injection line from the relief valves set at 500 psig on the individual injection lines. EPA will retain some of the original language because it was supplied in PGV's application material. For example, the wording "an injection pressure switch that triggers visual and audible alarms in the control room as well as a computer printout" was from PGV's letter (see #101096) which states "There are both visual and audible alarms for the actuation of the pressure (PSH 4157) switch in the control room. This also includes a printout from the computer any time the switch is activated." EPA wants to remind PGV that "The permittee's failure in the application or during the permit issuance process to disclose fully all relevant facts, or the permittee's misrepresentation of any relevant facts at any time" may cause termination of a permit or denial of a permit renewal according to 40 CFR §144.40(a)(2).
- **37.d. Comment:** (162.4) One agency commented that items (c),(d),(e), and (g) make reference to the control room. This reference should be revised to the "control room at the plant" to avoid confusion with the instrument rooms located at the individual well pads.
- **37.d. Response:** EPA appreciates this clarification and the permit language is modified accordingly, with the exception of (c) which according to Comment 37.e cannot be read in the control room. It's assumed that this comment also applies to condition II.B.4.b.
- **37.e. Comment:** (108.36) II.B.4.c. PGV commented that the requirement of being able to read the nitrogen pressure in the control room is unnecessary, costly, and offers no additional protection of the USDW. The current practice of checking the nitrogen pressure is more than adequate to ensure proper monitoring.
- **37.e. Response:** As long as there is a continuously recording strip chart and gauge measuring annular nitrogen pressure and this is visually checked a couple of times daily, EPA will not require the transmission of annular nitrogen pressure data to the control room. The effectiveness of this system was demonstrated in detecting the KS-3 leak in the tubing (see record of communication #101688; and March 3 and March 31, 1998 letters from Jack Dean to William Wong).
- **37.f. Comment:** (108.37) II.B.4.d. PGV commented that the permit does not contain any limitations on the injection rate, other than Part II.D.3. which simply provides that the flow rate will not cause an exceedence of the pressure limitation. This condition requiring monitoring of flow rate, when flow rate is unrestricted, should be deleted from the permit.
- **37.f. Response:** Part II.D.3. in its entirety states "The injection rate shall not cause an exceedance of the injection pressure limitation in Part II.D.2.a. Should the maximum injection rate increase to a point where it appears that the maximum injection pressure limitation will be exceeded, then the EPA will reconsider setting maximum injection rate limitations." To determine if the maximum injection rate is approaching a point where the maximum pressure limitation would be exceeded, EPA needs to monitor injection rate which is "a direct measurement by a flow meter" (see letter #101096). Should a leak occur

in the casing, this information will also help EPA determine how much injectate has been lost to the formation and possibly the USDW depending on at what depth the leak occurs. This is also basic information that is required in nearly all EPA UIC permits for high-technology wells whether they are authorized by rule or permit (40 CFR §§144.28(g)(1)(ii), 144.28(g)(2)(ii), and 144.28(g)(3)(ii)). In addition, PGV has been monitoring and reporting this for the over the last six years under the DOH permit (see monitoring records in the #300,000s).

- **37.g. Comment:** (108.38, 108.41) II.B.4.d and II.B.4.g. PGV suggested combining II.B.4.d and II.B.4.g because they overlap with respect to their intended coverage. If a flow monitoring provision is included in the final permit, a combined provision should read: "(d) on each injection well (i) a continuously recording flow recorder; (ii) a flow indicator; and (iii) a flow totalizer." Specifying the type of meter or device to be used is too confining. This conditon should not specify an "ultrasonic" flow transmitter. Indeed, the requirement of a flow transmitter in (d) on the combined injection line should be deleted completely because it is unnecessary to protect the USDW and a flow totalizer achieves the same purpose--a continuous total of flow. Moreover, the cost of installing the flow transmitter would be approximately \$40,000.
- **37.g. Response:** Conditions d and g are merged in the final permit. The language is a combination of what PGV suggested, the existing conditions and language consistant to that section. Secondly, the requirement of an ultrasonic flow transmitter is in the permit because that is what PGV said that it was using in its application material (see letter #101096) which states "There is an ultrsonic flow transmitter on the combined reinjection flow line." EPA will drop the word "ultrasonic" to facilitate the process of converting to another type of flow transmitter should that occur. However, EPA will keep the condition of requiring the flow transmitter on the combined flow reinjection that that can be read in the control room. Should the combined flow injection line become overpressurized and flow has to be reduced, it important that the control room operator to be able read the flow in the line to acertain that it is being reduced. Thus avoiding overpressurizing the injection zone and possibly fracturing the confining layer between the injection zone and the USDW. If the information in PGV's application material is correct, then PGV should not have to install an ultrasonic flow transmitter on the combined (flow re)injection line because it is already there.
- **37.h. Comment:** (108.39) II.B.4.e. PGV commented that there are no injection line temperature recorders on the wells. Periodic readings taken at the wells by operators are adequate. Temperature measurements are only relevant for geothermal reservoir and plant equipment analyses. Accordingly, the following language should be used: "(e) A temperature indicator located on the injection line upstream of the wellhead of each well." PGV notes that the cost of temperature indicators would be high.
- **37.h. Response:** As long as temperature is checked daily, EPA will not require the transmission of temperature data to the control room. However, knowing the injectate temperature over time is a critical piece of information in interpreting temperature logs for the determination of mechanical integrity. Injectate temperature is critical information during sampling because constituents in the injectate may take different physical and chemical forms depending on temperature. In addition to chemical changes, temperature changes may indicate impacts to the USDW from a leak in the casing or a blowout (see Response 5.a regarding the increase in temperature at MW-2 after the blowout of KS-8).
- **37.i. Comment:** (108.40, 162.5) II.B.4.f. PGV and DLNR questioned the applicability of Item (f), which requires a continuously recording flow meter at the production wells. This should not be a requirement of the UIC Permit since production wells currently fall under the jurisdiction of the Department of Land and Natural Resources (DLNR) and not the DOH. Additionally, it was DLNR's understanding that the monitoring instruments involved are not very accurate and the influence of scaling and fouling has been shown to distort the accuracy of measurements taken. It should be further noted that the installation of a flow meter on production wells does not of itself result in an accurate calculation of the total volume for

the different flow rates of the production wells, nor does such metering effectively measure the total volume of steam condensates produced as a result of the energy conversion process at the plant.

- **37.i. Response:** Condition II.B.4.f which requires a continuously recording flow meter at the production wells will be deleted from the UIC permit. This is done in recognition of DLNR's regulation over the production wells.
- **37.j. Comment:** (108.79, 162.6) PGV and DLNR questioned whether in regards to injectate monitoring (constituents and temperature), the reinjection of geothermal fluids (brine and steam condensate) extracted from the reservoir realistically considered a contamination concern when it is reinjected into a zone in close proximity from where it was extracted, and there are mechanisms in place to insure the protection of the USDW. DLNR went on to say that in discussions with EPA staff, EPA could not give a definite answer as to whether brine and steam are considered contaminants. If it is not considered a contaminant, any restriction on the total quantity reinjected fluids might be considered an inappropriate permit limitation.
- **37.j. Response:** EPA's draft permit allow the reinjection of brine, condensate and noncondensible gases into the injection zone, which is not a USDW, in recognition that it was produced from a nearby zone. Injectate monitoring is conducted to determine compliance with the conditon that only permitted fluids be injected. EPA is also requiring injectate monitoring so that if injectate were to leak into the USDW, EPA would know what was entering the USDW and could look for it in the groundwater monitoring wells. This information may also be useful to PGV and DLNR because a subtle change in fluid chemistry can indicate production well casing failure and a loss of mechanical integrity (see well failure report #200038).

Regarding mechanisms in place to protect the USDW, while PGV currently has mechanical integrity in KS-1A and KS-4, the earlier corrosion in the casing of KS-1A and KS-3 and the leak in the tubing of KS-3 demonstrates, that over time, no system is leak proof. EPA is requiring that the temperature be monitored because this information is essential in determining external mechanical integrity using temperature logs and in sampling.

As for the definition of contaminant, it is very broad. According to 40 CFR §144.3, "Contaminant means any physical, chemical, biological or radiological substance or matter in water."

38. Re: Proposed Changes and Workovers (II.B.5)

- **38.a. Comment:** (92.15) Native Lands Institute commented that notice to EPA for any planned physical alterations or additions to the wells or planned conversion should be sixty (60) days in advance instead of seven (7) so EPA can properly review any dangers posed by the alterations. Puna Malama Pono should also be given 60 days notice of proposed alterations, additions or conversions.
- **38.a.** Response: The final permit keeps the seven (7) days advance notice of physical alterations or workovers to the wells, because EPA believes this is adequate notification in which to assess the activity. The permit shall retain the requirement of notifying EPA forty-five (45) day prior to any conversion to an injection well and this condition is moved from II.F.1 to II.B.6, the section on new wells and well conversions. EPA will notify Puna Malama Pono or any other interested party who contacts EPA with a request for this information.
- **38.b. Comment:** (108.42) PGV commented that the reference to the term "alterations" or planned physical changes and additions to the injection wells is unclear. "Conversion" of wells and the "rework" of wells are different. The term "rework" should be used instead as discussed in Part II.B.3. Additionally, the reporting form in Appendix C expires on June 30, 1998 and will no longer be valid after that date. Second, the wording of the certification printed at the bottom of the form differs significantly

from the certification required by the UIC regulations at §144.32(d). Because it is unauthorized after June 30, 1998 and inconsistent with the UIC regulations, PGV objects to the use of the form.

38.b. Response: The final permit contains the language "any planned physical alterations or reworking to the wells." Because "planned physical alterations" includes "additions" to the permitted injection wells, "additions" is deleted in the final permit. EPA is aware of the fact that a well conversion is different from reworking a well. To clarify that in the permit, rather than including well conversions with "Proposed Changes and Workovers", the permit will be modified to have well conversions as a separate section, titled "New Wells and Conversions", which will specifically enumerate what notification and information is needed for a new well or conversion. As for guidelines on the definition of "rework", see Response 36.a.

EPA Headquarters has posted the 7520 forms, including 7520-12 (Well Rework Record) on its website for permittees to use (http://www.epa.gov/agcyintr/info.htm under FormSmart). These forms do not have an expiration date. Form 7420-12 has been approved by the U.S. Office of Budget and Management, so the certification language has been approved. If PGV wants to include the full signatory certification language from §144.32(d), they are welcome to do so. If PGV does not want to use the convenient form, they can submit a workover report containing the information in Form 7420-12 along with the signatory certification.

39. Re: Corrective Action (II.C)

- **39.a. Comment:** (108.43) PGV objects to all of the corrective action provisions in the permit because they are not needed to ensure USDW protection and should be deleted. PGV commented that EPA typically requires Corrective Action Plans for UIC Permit Applications for other well types. Corrective action requirements are not applicable to Class V wells, and EPA cannot impose such requirements on PGV. See 40 CFR §144.55(a) (corrective action rule covers" [a]pplicants for Class I, II,...or III injection well permits").
- **39.a. Response:** EPA Region 9 has required corrective action plans in permits for Class V wells, including another Class V well permit in Hawaii where the area of review was 1/2 mile. Under 40 CFR §144.52(a)(9), EPA "shall impose on a case-by-case basis such additional conditions as are necessary to prevent the migration of fluids into underground sources of drinking water." This includes corrective action, the intent of which is "to prevent fluid movement into underground sources of drinking water" (§§144.55[a] and 146.7). As to how the corrective action requirements are designed to protect the USDW, refer to the applicable responses under 40 and 41.

40. Re: Area of Review (Under Corrective Action, II.C.1)

- **40.a. Comment:** (92.16) Native Lands Institute commented that the area of review does not adequately reflect the area likely to be impacted by operations and emergencies at PGV. The commenter believed that impacts in emergency situations could radiate as far out as four miles. The area of review should correlate with the area likely to be impacted so as to provide adequate assessment of impacts on members of the surrounding community.
- **40.a. Response:** The UIC area of review pertains to potential contamination of a USDW and not air emissions. As defined in 40 CFR §146.6, the area of review (AOR) includes the following: if it is calculated, it is the lateral distance in which the pressures in the injection zone may cause the migration of the injection and/or formation fluids into an underground source of drinking water; if a fixed radius is used, then it is a fixed radius around the well of not less than 1/4 mile. In the case of an application for an area permit, a fixed radius of not less than 1/4 mile for the circumscribing area may be used. The latter is what was used in the draft permit because the application was for an area permit.

- **40.b. Comment:** (108.44, 162.7) PGV and DLNR commented that if the permit were an area permit, then a 1/4 mile AOR around the property boundary would be acceptable. However, the permit is an individual permit. Therefore, the 1/4 AOR radius should be from the wellhead of the injection well surface location according to DLNR or the boundary of the well pads according to PGV since the location of future wells would be restricted to the well pads. As noted earlier, siting requirements, including but not limited to, project development boundaries and the location of the well pads are presently regulated by applicable State and County permit conditions. To the extent possible, EPA's area of review should be delineated in coordination with present State and County regulation provisions.
- **40.b. Response:** In the draft permit, the area of review extends 1/4 mile beyond the property boundary because PGV supplied a map with that information in its application for an area permit (40 CFR §146.6[b][2]). Also, at the time the draft permit was issued, PGV had not given EPA the location of new wells. So an AOR around the property boundary encompassed all possible locations where new wells might be located. During the application process, EPA gave PGV the option of submitting existing and proposed well pad rather than the exact location of proposed wells to give the facility flexibility in siting wells. PGV submitted a map with that information at the public hearing on the draft permit. Based on the receipt of that information, the final permit has an AOR that is an aggregate of 1/4 mile radii around the boundaries of the existing and proposed well pads. This approach has been used before when individual radii overlap. The boundary of the well pad is used because the wells may be drilled anywhere on the well pad. Given that some of the proposed well pads are fairly large (i.e. Pad G is approximately 660 feet by 940 feet which is 620,400 square feet), the radii around these wells pads are fairly large. When overlaid upon each other, the AOR, for the most part, covers the property boundary and extends approximately 400 to 700 feet beyond the property boundary. The map of the new AOR is in Appendix B

As for the comment that the area of review for an individual permit should be a 1/4 mile radius from the wellhead of the injection well surface location, §146.(b)(1) states that "A fixed radius around the well of not less than 1/4 mile may be used" for applications for individual permits. EPA is not limited to 1/4 mile radius, nor is the radius limited to just the wellhead of the injection well surface location, but it extends from the entire length of the well.

Regarding the comment that to the extent possible, EPA's AOR should be delineated in coordination with present State and County regulation provisions, EPA's AOR should not impact State and County regulations because the AOR is the area in which EPA looks for abandoned, improperly plugged and improperly completed wells that could provide a conduit to the USDW.

- **40.c. Comment:** (92.18) Native Lands Institute commented that PGV should be required to assure EPA that geothermal fluids won't migrate into a USDW before EPA approves plans, not just submit a plan to show how it can be prevented.
- **40.c. Response:** If PGV's injection activities allow the movement of fluid containing any contaminant into the USDW, then this will be a violation of the permit and §144.12(a).
- **40.d. Comment:** (108.45) II.C.1.b. PGV commented that the primary purpose of the corrective action provision is to address any potential for an increase in injection zone pressure which would cause fluids to migrate through existing wells to a USDW. The plan is designed to demontrate why injection activities would not affect other wells in the AOR in a manner that could endanger the USDW, or to present the steps that would be taken to prevent the migration of fluids into the USDW. The buildup of reservoir pressure and the effects this can have on existing wells in the project vicinity are simply not issues at PGV. This is primarily due to the balancing effect that PGV's injection/production operations have on reservoir pressure and secondarily, to the unique hydrogeology of the area. Years of data show that reservoir pressure is not increasing. The permit condition is inconsistent with the corrective action evaluation criteria set out in 40 CFR §146.7, and the requirement in no way further USDW protection.

40.d. Response: The primary purpose of the corrective action provision in 40 CFR §144.55(a) is to "submit a plan consisting of such steps or modifications as are necessary to prevent the movement of fluid into underground sources of drinking water (`corrective action')" from "improperly sealed, completed, or abandoned wells" that are part of "all known wells within the injection well's area of review which penetrate the injection zone". According to the aforementioned regulation, EPA may also prescribe a corrective action plan if the one in the permittee's application is inadequate or deny the application.

EPA recognizes that the shut-in downhole pressures for all three injection wells, after peaking in 1994, have decreased over time until they approximated the static reservoir pressure prior to the startup of injection operations (see letter #101146). EPA also acknowledges PGV's explanation of this attributing it to establishing communication between the injection and the production zones and the injection of relatively colder, denser fluids (see letter #101146: and PGV's comments #600467-600479 & #500522-500525). However, wells do not have to be affected by injection pressure to be included in corrective action according to §144.55(a). PGV's comment linking corrective action to "an increase in injection zone pressure" applies to Class II wells operating over the fracture pressure of the formation according to §144.55(a) which states "or in the case of Class II wells operating over the fracture pressure of the injection formation, all known wells within the area of review penetrating formations affected by the increase in pressure."

At PGV, an increase in pressure is not necessary to cause the upward migration of injected fluids. The injection zone is already naturally pressurized from the deeper heat source (temperatures encountered when KS-1A was drilled were in excess of 600 degrees Fahrenheit) (see PGV state application #100095). This is why injection wells KS-1A and KS-3 were original considered for production (see letter #200104; and Casing Monitoring Program #200131-200132). The addition of injected fluids will cause the displacement of formation fluid and eventually injected fluids. If the injected fluids migrate to another area that is naturally under pressure or where convection is occuring, and there is a man-made or natural conduit, then the pressure can force the fluids up towards the USDW. PGV's application material shows "upflow in permeable fracture" from the injection zone to the USDW (see letter #101079). The higher TDS and increase in certain chemical constituents in the USDW indicate that geothermal fluids have already made their way to the USDW along fractures or faults despite the confining layer and without overpressurization of the injection zone. This is echoed in PGV's 1989 UIC application to DOH which indicates that there is "significant natural geothermal fluid leakage into the groundwater zone" (see PGV state application #100115 & #100088). There is also the possibility that injected brine may cause the deposition of secondary minerals in the injection zone, thus decreasing permeability which could result in an increase in reservoir pressure in the vicinity of the injection wells. Because the PGV facility is located on an active rift, there is also the possibility that the movement of magma at depth may heat geothermal fluids underneath the PGV site and cause an increase in pressure through that mechanism. EPA's concern is that improperly plugged or completed wells may exacerbate the migration of geothermal fluids, including injected fluids, into the USDW.

At the time the comments were made, PGV's balancing effect of the injection and production wells was theoretical as indicated in PGV's application which stated "[A]Ithough not physically confirmable, it is considered most likely that the two production wells are hydraulically connected to the injection reservoir and that at least a portion of the injectate returns to the production wells." Since that time, PGV has obtained permission from DOH to run tracer tests to determine if the injectate is reaching the production wells (see letters #102837-102847, #102902, & #102903). The results of these tests will indicate if the injected fluids are reaching the production wells.

In determining the adequacy of corrective action proposed by PGV and in determining the additional steps needed to prevent fluid movement into USDWs, EPA did consider the factors listed in 40 CFR §146.7, such as hydraulic connections with underground sources of drinking water, hydrology, geology, history of injection operation, and abandonment procedures, etc. In the interest of protecting the USDW,

the permit prohibits the construction of a new well or the conversion to an injection well near HGP-A and SOH-1 until corrective action has been taken. Refer to Responses 41.a and 41.c for what this entails. The final permit acknowledges that corrective action can be taken to prevent the movements of fluids into the USDW from improperly sealed, improperly completed or abandoned wells.

- **40.e. Comment:** (108.46) PGV objects to EPA's requirement in Part II.C.1.b. that "temporarily abandoned" wells be plugged and abandoned prior to construction of new injection wells. 40 CFR §144.55 speaks only of evaluating for corrective action wells within the AOR that have been improperly sealed, improperly completed, or improperly abandoned, and that also penetrated the injection zone. EPA has added the "temporarily abandoned well" catagory. What does "temporarily abandoned" mean and would this include a well that is temporarily out of service but that may be used again sometime in the near future?
- **40.e. Response:** "Temporarily abandoned" is defined in §144.28(c)(2)(v) as "any well that has been temporarily abandoned (ceased operations for more than two years and has met the requirements of paragraphs (c)(2) (A) and (B) of this section)". Requirements (c)(2) (A) and (B) includes providing notice to the EPA; and describing actions or procedures, satisfactory to the EPA, that the owner or operator will take to ensure that the well will not endanger USDWs during the period of temporary abandonment. These actions and procedures shall include compliance with the technical requirements applicable to active injection wells unless waived by the EPA. A well that was temporarily abandoned could be used in the near future if EPA were notified prior to use as required in §144.28(c)(2)(v).

For condition II.C.1.b., EPA was thinking of the situation described in §144.28(c)(2)(iv) in which a well has not been used for two year and the owner or operator, having not met requirements (c)(2) (A) and (B), has to plug and abandon it. The regulations are silent on what that type of well would be called. EPA will modify the permit to remove "temporarily abandoned" and will assume that "improperly abandoned" covers this type of well.

- **40.f. Comment:** (108.48) II.C.1.c. PGV commented that EPA's Corrective Action authority only extends to an injection well's potential to affect other types of wells that could, in turn, negatively affect a USDW. II.C.1.c. inappropriately extends to a non-injection well's potential to affect the USDW independent of any injection activity.
- **40.f. Response:** These other types of wells could also provide conduits into the USDW from the injection zone if they penetrate it. EPA had also included this condition because EPA was told by DLNR and PGV that all wells would be drilled as production wells, even wells intended for injection operations. In the final UIC permit, corrective action plans are only required for injection wells, because it is the responsibility of DLNR to address corrective action in regards to production wells.
- **40.g. Comment:** (92.17) Native Lands Institute commented that proper plugging and sealing should be given a definite deadline, within X number of days of the issuance of the UIC permit, rather than the indefinate standard of "prior to constructing new wells."
- **40.g. Response:** According to §144.55(b)(1-2), the corrective action compliance schedule shall be completed as soon as possible for existing injection wells and before injection begins for new wells.

41. Re: Corrective Action (II.C.2)

41.a. Comment: (17.3, 49.3, 101.4, 108.47, 108.49, 155.7) PGV and a few other people commented that Condition II.C.2(a) requires the permittee to conduct mechanical integrity tests on the abandoned scientific observation well know as SOH-1. If mechanical integrity cannot be demonstrated for SOH-1, the permittee is responsible for the proper plugging and abandonment of SOH-1. SOH-1 is a State project on a separate property from that of PGV's. EPA does not have the authority to require PGV to do

work on SOH-1, which is intended to serve as a long-term monitoring well to detect the impacts of geothermal fluid withdrawal from the reservoir by PGV. The State has fiduciary responsibility to monitor the effects of geothermal production on the reservoir. PGV commented that SOH-1 should not be included in corrective action because it does not penetrate the injection zone, and PGV's injection activities would not cause a pressure buildup in the injection zone because production balances injection.

41.a. Response: To do work on another's well, be it the State or a private land owner, PGV would have to obtain access to the land and permission to work on the well from the owner. This is what happened in the case of monitoring well GTW-III. PGV obtained permission to access and rehabilitate GTW-III so that it could be used as a monitoring well (see PGV application #100863). PGV also contracted with the State to use the Malama Ki well (see PGV application #100863). In a January 15, 1997 letter to EPA, PGV proposed running logs on SOH-1 as a permit condition if an injection well were drilled within 1/4 mile of SOH-1 (see #101181). While it appears that PGV is leasing the land that SOH-1 is on (see PGV application #100723 & #100726), EPA cannot make PGV do work on the State's well if PGV does not receive permission. However, EPA can prohibit PGV from drilling new wells within the area of review (1/4 mile) of SOH-1 because the SOH-1 could provide a conduit from the injection zone into the USDW as is explained in this response.

As for being used as a monitoring well, SOH-1 was used for five months in 1993 to monitor reservoir pressure after injection began on April 12, 1993 (see letter #101110). However, it has not been used for monitoring purposes since then. In an April 1, 1998 meeting between EPA, DOH, DLNR, and the County of Hawaii, Eric Tanaka of DLNR said that his agency does not have the money to conduct monitoring at SOH-1, nor analyze the results.

SOH-1 pentrates the injection zone. Well schematics for KS-3 show open borehole from 3,897 to 7,316 feet (all depths in this section are in reference to the Kelly Bushing which is 25 feet above the top of the well cellar unless otherwise stated), some of which has slotted liner (see PGV application #100830-100832). KS-1A and KS-4 have cemented casing extending slightly deeper and are not as deep as KS-3. So the open borehole in KS-3 represents the maximum possible injection zone. While the injection well temperature logs indicate that the permeability of the formation increases below 4,900 feet, there are permeable zones above that (see PGV state application #200132). SOH-1 has open borehole (with uncemented casing and perforated liner) from 1,996 to 5,526 feet (see PGV application #100729). A temperature log indicates that the bottom 1,200 feet of SOH-1 (from 4,300 to 5,526 feet) is impermeable (see PGV application #100734; letter #101145; and PGV comments #600467-600479). Above this impermeable zone, there appear to be permeable zones in the open borehole. This means that there is is approximately 403 feet of overlap between PGV's potential injection zone from 3,897 to 7,316 feet and the more permeable section of SOH-1 above 4,300 feet. In its application, PGV states that "the principle injection zone is below 5,000 feet", although "less than 5,000 feet below ground surface, which is within the transition zone, there are occurrences of minor permeability which are inferred, by their temperature, to be part of the geothermal systems" (see #100762). An earlier application to the DOH has the caprock extending to 4,000 feet, but acknowledges that the "boundaries are variable and dependent upon the local permeability (fractures)" (see PGV state application #100088).

An increase in pressure was not observed in SOH-1 during the first five months of injection (see letter #101110). It is possible that the pressure was not detected in that time period because the low permeability in the injection zone and the distance between SOH-1 and the closest injection well which is approximately 1,800 feet away (see PGV application map #101154; and PGV comment #600524). It took approximately between one to two years for injected fluids to "break through" to the productions wells (this is PGV's interpretation of the reservoir pressure decrease seen in #101146) and production well KS-10 is closer to injection well KS-1A than SOH-1 is (see PGV comments #600525). An injection well located on Pad H, which is 300 feet from SOH-1, has the potential to have a more immediate impact on SOH-1 than the existing injection wells.

In addition to there being overlap between SOH-1 section of permeable open borehole and PGV's injection zone, it is unknown if SOH-1 has a good cement bond between the 7" casing and the formation, or if there are leaks in this casing because mechanical integrity tests have not been conducted within the last few years. A lack of external or internal mechanical integrity could allow deeper geothermal fluids to migrate into the USDW. If while drilling an injection well on the nearby Well Pad H, an underground blowout occurred and fractured the formation, as it did with injection well KS-8, geothermal fluids from the blowout could migrate along the fracture to SOH-1. Because the bottom 3,530 feet of the well is not cemented and the mechanical integrity of the cemented casing is unknown, SOH-1 could provide a conduit for the geothermal fluids to migrate upwards and into the USDW. At a minimum, an external and internal should be run on SOH-1 by some party. If it is shown that SOH-1 has mechanical integrity, then PGV will be able to drill new injection wells or convert wells to injection wells within the 1/4 mile radius surrounding SOH-1.

See Response 40.d as to why a pressure buildup in the injection zone is not necessary for injected fluids to migrate upwards. The blowout of a nearby injection well could also mobilize geothermal fluids and cause them to migrate towards SOH-1. There is also the possibility that the injection of increasingly saline brine (see PGV application #100938-100939) could cause the precipitation of secondary minerals that could decrease permeability (see paper #200018) and cause an increase in injection zone pressure.

41.b. Comment: (49.4, 92.19, 101.4) II.C.2.a. Native Lands Institute and a couple of other people commented that PGV should have to demonstrate the mechanical integrity of SOH-1 or plug and abandon it before the UIC permit is granted. If it is left unplugged, mechanical integrity should be demonstrated every six months instead of annually because this well is fairly old and problems may develop rather quickly, causing the contamination of USDWs and air and injuring area residents through releases of hydrogen sulfide.

41.b. Response: Refer to Response 41.a.

41.c. Comment: (17.3, 108.47, 155.3, 156.4) II.C.2.b. PGV and a couple of commenters stated that this condition which holds the permittee responsible for the proper plugging and abandonment of the temporarily abandoned production well know as HGP-A should be deleted because the Natural Energy Laboratory of Hawaii Authority is the owner of the property. The present owner is moving toward plugging and abandoning that well.

41.c. Response: This response is similar to Response 41.a. To do work on another's well, be it the State or a private land owner, PGV would have to obtain access to the land and permission to work on the well from the owner. This is what happened in the case of monitoring well GTW-III. PGV obtained permission to access and rehabilitate GTW-III so that it could be used as a monitoring well (see PGV application #100863). PGV also contracted with the State to use the Malama Ki well (see PGV application #100863). EPA cannot make PGV do work on the State well or another's property, if they do no have permission. However, EPA can prohibit PGV from drilling new injection wells or converting wells to injection wells south of the KS-9/10 fracture (also referred to as the KS-9/10 frault, KS-8 fracture, and mid-field fracture) until HGP-A is properly plugged and abandoned by some party for the reasons below (see PGV application #100731).

According to a map in PGV's application (see #100757), fluid from the injection zone is drawn toward the KS-9/10 fracture, where it migrates up the fracture due to natural pressure, and exits the fracture at various depths, moving into the surrounding aquifers, including south towards HPG-A. If fluids from the injection zone were migrating up the fracture, exiting it, and moving toward HGP-A, HGP-A could be a conduit for these fluids to migrate into the USDW. EPA believes that HGP-A could be a conduit for the following reasons. HPG-A has been suspended with a temporary plug, but a November 1995 pressure test of the casing above the plug indicated a leak of 0.19 gpm at 150 psi wellhead pressure (see PGV application #100730). EPA has not been presented with any information demonstrating that there is a

good cement bond between the casing and the formation. After HGP-A was drilled, a caliper and cement bond log run on the well indicated substantial deterioration of the cement because high-temperature cement was not used in the original casing program (see letter #200175). A workover in 1979 resulted in 80% bonding (see letter #200177 & #200154), however, it has not been demonstrated to EPA that there is no channelization of fluids occuring between the casing and the formation. A report done on geothermal well failure underscores this concern stating "Analysis of casing fauilures in the Italian geothermal fields found...that failures were always associated with problems that occurred during drilling operations, principally in the cementing stage " (see report #200039). That report also stated that investigators at Cerro Prieto, Mexico, and Wairkei, New Zealand "also reported casing failures that were closely associated with problems related to cementing of the wells." For these reasons, HGP-A should be properly plugged and abandoned by some party, which includes restoring external mechanical integrity if it is lacking.

Initially, "pressures in this [KS-9/10 fracture] zone are nearly 1,900 psi (134 bars) and as such exceed local hydrostatic pressures at depth near 1,000 feet by about 670 psi (47 bars, or 1,540 feet of coldwater head)" (see USGS report #100553). In its comments, PGV indicated that the production wells, which intersect the KS-9/10 fracture, have caused the pressure to drop significantly in the fault over the last five years (see PGV comments #600522-600525). According to these comments "The greatly reduced pressure in the mid-field fracture during production causes the the fracture to operate as a pressure sink, inducing fluid flow from the injection wells and the surrounding reservoir into the mid-field fracture." Therefore, the production wells decrease the probability of fluids exiting the fracture and moving toward HGP-A. Based on this information, the permit is modified to prohibit PGV from drilling any new injection wells or converting wells to injection wells on the south side of the KS-9/10 fractue, which is the side of the fracture where HGP-A is located until HGP-A is properly plugged and abandoned, and EPA has examined the plugging and abandonment reports to ascertain this.

At the time of this writing, the Natural Energy Laboratory of Hawaii Authority is in the process of permanently plugging and abandoning HGP-A.

- **41.d. Comment:** (162.8) DLNR commented that the corrective actions for the State owned wells, referred to as SOH-1 and HGP-A should be directly coordinated with DLNR, who raises the question of legal implications that may arise from the imposition of correction actions on the applicant, as a condition of the UIC Permit. Liability issues related to the applicant performing plugging and abandonment (P & A) work on State-owned wells must be further investigated before DLNR concurrence on this condition can be given.
- **41.d. Response:** Refer to Responses 41.a and 41.c.
- **41.e. Comment:** (92.20) II.C.2.b. Native Lands Institute commented that PGV should properly plug and abandon HGP-A before a UIC permit is issued, and should absolutely not be permitted to begin construction of any new injection wells until HGP-A is properly plugged and abandoned. A two-year deadline for proper plugging and abandonment is too long considering the age of the well and the threat it poses to the community. If the permit is issued with HGP-A still not properly abandoned, PGV should be required to plug and abandon within one year.
- **41.e. Response:** Refer to Response 41.c.
- **41.f. Comment:** (122.3) One commenter asked HGP-A needed to be plugged and abandoned. Why is EPA not allowing any injection wells to be drilled within a one-quarter mile distance from HGP-A? Is that a restriction that applies to the surface location or the down hole location or both? Does this include Wellpad E? Will injection wells be restricted on Wellpad E?
- 41.f. Response: HGP-A should be properly plugged and abandoned for the reasons specified in

Response 41c. As for the 1/4 mile distance, before EPA grants approval to drill an injection well, an area of review around the proposed well, field, protect or area is examined for abandoned or improperly completed wells which could provide a conduit for injectate from the injection zone to travel to a shallower USDWs. In the draft permit, EPA chose a 1/4 mile AOR around the property boundry. HPG-A falls within that AOR. Conversely, because HGP-A is an abandoned well with with problems, it makes sense not allow injection wells to be drilled within a 1/4 mile of HGP-A. A 1/4 mile is used because it is the minimum fixed radius that can be used according to 40 CFR §146.6(b)(1). The measurement is a 1/4 mile from the entire well, not just the surface expression of it. Except for the farthest northern corner, Well Pad E falls within 1/4 mile of HGP-A. However, this condition has been modifed. The final permit prohibits wells from being drilled south of the KS-9/10 fracture based on the reasoning in Response 41.c. There is no surface expression of the fracture, but it probably runs just south of Well Pad E and Well Pad F given that: 1) none of the wells on Well Pad E intersected it (although they deviate to the north at depth); 2) KS-7 intersected it (see record of communication #200113; and PGV application #100731); and it has an 82 to 85 degree dip (see PGV application #100731 & #100767). Injection wells are allowed on the part of Well Pad E as long as the wellbores remain north of the KS-9/10 fracture and the wells are 600 feet from the property line.

42. Re: Well Operation (II.D)

- **42.a. Comment:** (108.51) PGV commented that any time the word "leak" is used in this section, it should be peceded by the word "significant" because significant leaks are the expressed concern in Part II.D.2.a and c.
- **42.a. Response:** Part II.D.1.d of the permit is modified to include the word "significant" before the word leak to be consistant with the definition of mechanical integrity in 40 CFR §146.8. However, in II.D.1.c., the phrase "inspect the wellhead for leaks, repair any wellhead leaks found..." will remain as is because these actions have been triggered by the detection of a "a significant leak".

43. Re: Mechanical Integrity (II.D.1)

- **43.a. Comments:** (92.21) II.D.1.a. Native Lands Institute commented that the draft permit condition currently reads as follows: "The Permittee must show that there are no significant leaks in the casing and tubing and that there is no significant fluid movement into a USDW through vertical channels adjacent to the injection wellbore." The word "significant" should be omitted in both places where it appears here because the goal should be to prevent all movement of toxic geothermal fluids into USDWs in order to protect public health.
- 43.a. Response: According to 40 CFR §146.8(a), "An injection well has mechanical integrity if: (1) There is no significant leak in the casing, tubing or packer; and (2) There is no significant fluid movement into an underground source of drinking water through vertical channels adjacent to the injection well bore." (PGV's injection wells lack packers so that condition has not been included in the draft permit. In considering this comment, EPA realizes that there should also be no leaks in the wellhead and will add this to the permit.) Because the word "significant" is part of the definition of mechanical integrity, EPA will keep it in the section on mechanical integrity. In regards to the protection of public health, the following regulations, the intent of which is to protect human health, remain in effect: §144.12 (a), which stipulates that no owner or operatior shall contruct, operate, maintain, covert, plug, abandon, or conduct any other injection activity in a manner that allows the movment of fluid containing any contaminant into USDWs, if the presence of that contaminant may cause a violation of any primary drinking water regulation or may otherwise adversely affect the health of persons; §144.12(d) which states that whenever the EPA learns that a Class V well may be otherwise adversely affecting the health of persons, it may prescribe such actions as may be necessary to prevent the adverse effect; and §144.12(e) which says that EPA may take emergency action upon receipt of information that a contaminant which is present in or likely to enter a public water system or USDW may present an

imminent and substantial endangerment of the health of persons.

- **43.b. Comment:** (108.52) PGV commented that the second sentence of this provision is unclear. PGV proposes the following alternative language for II.D.1.c., second sentence: If this occurs (i) at times other than the annual casing pressure test; (ii) at times other than during normal shut in of a well for repairs, wellhead changeout, annual maintenance outage, or other normal operation and maintenance situations; or (iii) at any time the gas/fluid interface cannot be maintained at a depth below the bottom of the USDW, then the permittee is required to inspect....
- **43.b. Response:** The final permit incorporates the phrase "normal shut in of a well for repairs, wellhead changeout, annual maintenance outage, or other normal operation and maintenance situations". Permit condition II.E.2.c. requires PGV to make notations on the injection wellhead pressure, injection rate, and annulus pressure distinguishing between periods of use and nonuse. This can be used to account for pressure drops caused by operations and maintenance activities. The permit will keep the 2,000 feet because this is consistent with the July 29, 1996 Casing Monitoring Plan (CMP) submitted in PGV's application (see #100887). This is also consistent with the 1993 CMP which required the nitrogen/water interface to be maintained more than half way down the annulus based on a nominal casing depth of 4000 feet (see PGV application #100887). The language "annual casing pressure test" was deleted from this condition, because an annular pressure decrease of more than ten percent in five hour would constitute a significant leak if it occurred during a annual pressure test.
- **43.c. Comment:** (108.53) II.D.1.d. PGV commented that this condition is not necessary since the handling of significant leaks is adequately addressed by Part II.D.1.c. If, however, this provision is not deleted, it should be restated as follows: "If significant leaks are detected in two or more injection wells at the same time, the procedures in II.D.1.c. should be followed, and if necessary, the control operator will adjust the operation of the plant to avoid violation of this permit."
- **43.c. Response:** With the exception of the last sentence which requested that mechanical integrity be demonstrated before a well is returned to operations, this language was taken directly from PGV's application, Attachment O, Plans for well Failures (see letter #100834). Because the purpose of the condition is to prevent the use of injection wells that lack mechanical integrity and thus possibly contaminate the USDW, EPA is retaining this condition.
- **43.d. Comment:** (108.54) II.D.1.d. PGV comments that Part II.D.5 (Upset Conditions) prohibits disposal of fluids on the ground. This if fully sufficient to deal with the concern raised in the second sentence of Part II.D.1.d.
- **43.d. Response:** While PGV writes that Part II.D.5 is fully sufficient to deal with the concern raised in Part II.D.1.d, PGV later contests the conditions in Part II.D.5. as being unacceptable. Parts II.D.1.d. and II.D.5 are sufficiently different to keep both in the permit. Part II.D.1.d specifies that injection wells will be shut in if leaks or mechanical integrity failures are detected for multiple wells and that mechanical integrity shall be demonstrated before a well is returned to operations. Part II.D.5 prohibits the disposal of brine on the ground in the event of an upset of facility operations where the injection well cannot be used and direct the permittee to contact EPA and other appropriate agencies.
- **43.e. Comment:** (92.22) II.D.1.d. Native Lands Institute questioned PGV's ability to quickly shut in a well in response to detected leaks. The ability to shut in an injection well depends on PGV's ability to store the brine coming up out of the production wells during the shut-down process. Production wells cannot be shut-in quickly enough without causing damage from thermal shock and blow-out.
- **43.e.** Response: Refer to Responses 10.a, 15.a, and 43.c.
- 43.f. Note: Section II.D.1.a has been modified to require mechanical integrity demonstrations for

injection wells that are being used for reservoir monitoring.

44. Re: Injection Pressure Limitations (II.D.2)

- **44.a. Comment:** (108.55) II.D.2.a. PGV commented that injection well pressures can vary from well to well. The appropriate and actual Maximum Injection Wellhead pressure of the KS-4 well is 685 psig.
- **44.a. Response:** This issue was raised during a meeting/conference call with EPA, DOH and PGV. The question was asked why the DOH permit set 500 psig as the Maximum Injection Wellhead pressure limitation for all three wells if KS-4 could operate safely at 685 psig (see DOH permit #200588). The response was that even though KS-4 has been tested and can safely inject at 685 psig, all three injection well share a common header. With this configuration, it is not possible to raise the maximum injection wellhead pressure for KS-4 to 685 psig without also raising by that same amount for KS-1A and KS-3 whose maximum injection pressure has been calculated to be 500 psig. (According to PGV's application #100771-100776, the drilling histories of KS-1A and KS-3 do not indicate that formation pressure tests were done, so the test results of KS-4 were applied to KS-1A and KS-3, but with a larger than normal factor of safety.) PGV responded that the permit should be changed and in the future the piping could be changed. EPA will issue a permit with conditions for the current piping configuration at PGV. Should the configuration be changed, allowing the maximum injection wellhead pressure to be increased for KS-4 but not for KS-1A and KS-3, then the permit can be modified to reflect this.
- **44.b. Comment:** (108.56) II.D.2.c. PGV commented that this condition should be revised to read as follows: "All UIC well equipment (piping and valves) at the injection wellhead shall meet API standards for injection pressure". This language should be used because injection operations begin at the wellhead. Contrary to PGV's previous advice, EPA was originally correct in using the API standards. The reference to "safe and leak-free condition" should be deleted because it is dealt with adequately in Part III.E.5.
- **44.b. Response:** EPA will modify the permit to read "API" rather than "ANSI". The rest of the language is retained in the permit because just as leaking injection wells can endanger the USDW, leaking pipes, valves and other facilities (e.g. pumps) crucial to injection operations can also endanger USDWs. Part 144.51(e) on proper operation and maintenance states that "The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit...." At the beginning of operations at the Geysers Field in California, the principal failure of the surface equipment was with pipes and valves (see report #100023). Understandably, the California Division of Oil, Gas, and Geothermal Resources also has a condition in its permits requiring that pipes be leak free (see PGV comments #600500 & #600503).

45. Re: Injection Rate Limitation (II.D.3)

- **45.a. Comment:** (92.23) Native Lands Institute commented that specific injection rate limitations should be set to ensure that the receiving formations are not fractured.
- **45.a. Response:** Injection rate limitations do not need to be set to prevent fracturing the receiving formation. The maximum injection pressure limitation addresses that concern. The permit specifies that the injection rate shall not cause an exceedance of the injection pressure limitation set in Part II.D.2.a. To address the concern of fracturing the formation, a condition has been added to the permit that directly prohibits PGV from fracturing the formation just in case the calculated injection pressure limitations for KS-1A and KS-3 are not adequate.
- **45.b. Comment:** (162.11) DLNR commented that during the generation of electrical power, the steam ratio and amount of steam and brine fluids produced can change over time. Given that the quantity of

fluids to be reinjected may also vary, sufficient flexibility should be provided as to the quantity of fluids permitted for reinjection.

- **45.b. Response:** There is no restriction on the total quantity of the reinjected fluids in the EPA UIC permit. There is the condition should the maximum injection rate increase to a point where it appears that the maximum injection pressure limitation will be exceeded, then the EPA will reconsider setting a maximum injection rate limitation, but it does not specifically limit quantity. That condition was added to address the concern of possibly fracturing the formation.
- **45.c. Comment:** (108.57) PGV commented that Part II.D.3. of the permit appears to imply a relationship between injection rate and injection wellhead pressure. There is no such relationship at PGV's facility due to the transmissivity and the lack of a reservoir pressure buildup. Injection flow rate at PGV has no effect on the confining layer. Moreover, the injection rate will not provide any warning concerning the injection pressure. Therefore, there is no valid basis for imposing a condition regarding injection rates, including the tracking of these rates.
- 45.c. Response: From July 1, 1994 to May 31, 1996, a slight increase in wellhead pressure coincided with a slight increase in injection rate in KS-3 (see PGV application #100773). In 1994, shut-in downhole pessure peaked for all three injection wells following the commencement of injection and an increase in combined total injection rate (see letter #101146). PGV attributed that to possibly a buildup of local pressure until communication was established with the production wells. At this point in time, because of the transmissivity of the injection zone, there is no buildup in injection zone pressure even though injection rates have increased. However, it is unknown if this will be the case in the future. The injection zone has relatively low permeability (see PGV application #100762) and scaling or seismic events could decrease permeability, thus reducing transmissivity. Additionally, it's unknown how a further increase in injection rates will increase the reservoir pressure. While the injection rate will not provide a warning concerning the injection pressure, an observed increase in injection rate may explain an observed increase in injection pressure. Monitoring the injection rate is a standard requirement for high-tech wells such as PGV's (see 40 CFR §§144.28(g)(1)(ii), 144.28(g)(2)(ii) and 144.28(g)(3)(ii)). Knowing the injection rate allows EPA to calculate the amount of injectate lost should a leak to the USDW or formation occur. This helps EPA determine if such a leak can be anticipated to be detected in the groundwater monitoring wells.

The permit is not setting injection rate limits, unless the injection rates increase to a point that it appears that the maximum injection pressure limitation will be exceeded.

46. Re: Injection Fluid Limitation (II.D.4)

- **46.a. Comment:** (108.58) PGV commented that there are no bases for limiting many of these fluids because the limitations are not related to protection of the USDW. This condition does no more than restate what fluids the facility typically injects.
- **46.a. Response:** This section lists the fluids that are permitted for injection at PGV. That is why it looks like a list of what the facility typically injects. It does not limit the quantity of any of the listed fluids.
- **46.b. Comment:** (108.59) PGV commented that there is no Chemical Additives Management Plan, only a list of chemicals. Therefore, this reference should be revised or deleted. Further, for PGV to have to seek approval of changes in chemical additives that serve the same purpose as those listed is burdensome. Keeping in mind the minimal quantities and low risk nature of the treatment chemicals, advising EPA of the change would be fully sufficient.
- **46.b. Response:** The Chemical Additives Managment Plan consists of the list of chemicals in Appendix F "Chemical Additives" and approval process in DOH's permit for these chemical additives.

Because of the small quantities being used and DOH's approval process for these chemical addititives, the permit has been modified so that PGV shall report to EPA on the use of any new chemical additive for process ssytem and well casing biofouling, corrosion, and scale control, and tracers. PGV shall also provide EPA with a copy of each additive's Material Safety Data Sheet, so EPA will know the origin of these chemicals if they are detected during sampling, and what is entering the USDW should a leak occur.

47. Re: Upset Conditions (II.D.5)

- **47.a. Comment:** (92.24) Native Lands Institute commented that PGV does not have the storage capacity for brine to allow it to stop using injection wells during upset conditions. PGV would have to shut in it production wells to stop the flow of brine, but it cannot safely shut in those production wells in the amount of time gained by using its brine storage facilities without risking thermal shock. This poses a risk to residents and farms surrounding PGV.
- **47.a. Response:** Refer to Responses 10.a, 15.a, and 43.c.
- **47.b. Comment:** (108.60) PGV commented that the sentence, "In the event of an upset of the facility operations where the injection wells can not be used, brine will not be disposed of on the ground", is unacceptable. The second sentence, which requires notification of the appropriate agencies, goes beyond USDW protection by requiring compliance with other laws and programs as a condition in the UIC permit. There are also no "Parts III.11. And 13." If EPA means Parts II.E.11 and 13, note that Part II.E.11 has no reference to other agencies and neither provision say anything about permits. It should be deleted.
- **47.b. Response:** The first sentence of this provision that "In the event of an upset of facility operations where the injection wells cannot be used, brine will not be disposed of on the ground" was taken from PGV application material in response to the question "Would brine be disposed of on the ground during upset conditions?" EPA did intend the provision to state Parts III.E.11 and 13. The permit will be modified to reflect that. Part III.E.11 refers to contacting EPA, whereas Part III.E.13 refers to contacting other agencies. Part II.D.5 is the provision that refers to other permits, not Parts III.E.11 and 13.

48. Re: Monitoring, Recordkeeping, and Reporting of Results

- **48.a. Comment:** (108.61) PGV made the comment that the monitoring devices specified in this section are not always consistent with the monitoring devices required in Part II.A.4 and are often redundant and confusing for the permittee, the regulators, and the general public to understand.
- **48.a. Response:** Refer to Response 22 as to why the redundancy exists. EPA will modify the pemit to eliminate, when possible, redundant monitoring and reporting requirement. The modifications will be noted in the comments on the individual conditions.

49. Re: Hydrologic Monitoring Program (II.E.1.)

- **49.a. Comment:** (108.63) PGV commented that it is unreasonable to require monitoring at the Malama Ki and GTW-III wells. PGV's does not own these wells and it is improper to require PGV to use non-owned wells.
- **49.a. Response:** The April 1990 Hydrologic Monitoring Plan (HMP) required monitoring with the intent of protecting the USDW. Under that plan, PGV was required to determine the flow gradient in the site vicinity by completing two on-site wells and rehabilitating a third well, GTW-III, for monitoring (see PGV application #100842). PGV obtained permission to access and rehabilitate GTW-III so that it could be used as a monitoring well (see PGV application #100863). PGV also contracted with the State to use

the Malama Ki well (see PGV application #100863).

49.b. Comment: (108.65) PGV commented that the purpose of the hydrologic monitoring program is to assess the effect of PGV on the USDW near the PGV facility. Thus, a monitoring well must be capable of measuring the possible effects of PGV on the USDW.

Data from the University of Hawaii Geothermal Monitoring Program (Thomas, 1995) demonstrates that Malama Ki is located in a separate aquifer, south of the Lower East Rift Zone. Commentors stated that Malama Ki should not be used as a groundwater monitoring well because it is in a separate aquifer as indicated by the following: 1) Malama Ki has more of a tidal influence than MW-2; 2) Malama Ki is across the groundwater gradient from PGV; and 3) geophysical work done in the early 1980's indicates a geologic feature that restricts water flow between Malama Ki and PGV, which is supported by the Lanipuna 1 well and side-track which showed temperature and permeability distinct from reservoir at HGP-A.

GTW-III is located in the "plume" of the PGV well field, but the quality of its ground water preclude its use for monitoring. With the exception of pH, the quality of the PGV injectate is at least as good as the ground water found at GTW-III. Very high temperatures and salinity content have resulted in monitoring equipment failure and loss of data. There is a very high variability in chemical constituents in GTW-III because samples have to be retrieved by bailer and the water in the well shows a high degree of stratification due to the density differences between the hot geothermal brines, cold sea water and cold fresh water.

49.b. Response: According to the 1990 Hydrologic Monitoring Program (HMP), which was originally required under the County's Geothermal Resource Permit, "The general objective of the HMP as stated, is to: `...monitor the shallow ground water immediately prior to, and during, all periods of well drilling, testing, production, and injection activity approved under the Geothermal Resource Permit." It was also intended to "document the hydrologic conditions in the shallow aquifer in existing wells that occur in the vicinity of the site and at a water supply well on the site prior to and over the duration of the project activities" through quarterly monitoring of water levels and appropriate chemical species (see County Geothermal Resource Permit #100205 & #100209; and PGV application #100842, #100847, and #100880).

Even if there was not a HMP, EPA would require groundwater monitoring wells in the vicinity of PGV to monitor any migration of fluids into the USDW. EPA has required this for other high-tech injection wells, with the type, number and location of the monitoring wells, the parameters to be measured, and the frequency of the monitoring subject to the approval of EPA (40 CFR §§144.28(g)(1)(iii) and 144.52(a)(9)).

The need to conduct groundwater monitoring is underscored by a 1994 USGS report "Potential Effects of the Hawaii Geothermal Project on Ground-Water Resources on the Island of Hawaii" which states that casing leaks and accidental well blowouts can release geothermal fluids into the shallow aquifer causing contamination of ground-water resources. "Subsequent contaminant migration could be rapid because of relatively high ground-water velocities in parts of the region. Hydrologic monitoring of observation wells needs to be continued throughout development of geothermal resources for the Hawaii Geothermal Project to enable the early detection of leakage and migration of geothermal fluids within the ground-water system." (See USGS report #100535)

EPA believes that the question of whether Malama Ki could detect impacts from PGV's activities is unresolved. This is based on conflicting information. If Malama Ki is in a separate aquifer, there are indications that there is hydrologic connection between the two. Groundwater, east of HGP-A and within the Lower East Rift Zone (LERZ), travels down-rift to the northeast (see USGS report #100555). South of the LERZ, groundwater migrates from the rift zone to the south-southeast towards the coastline (see USGS report #100556; and July 20, 1998 Comments of Puna Geothermal Venture on the U.S.

Environmental Protection Agency's Draft Class V Individual Permit No HI596002, Attactment 8). Therefore any groundwater that leaks out of the southern part of LERZ in the vicinity of HGP-A travels towards Malama Ki. There are indications that this is happening as seen in several zones of low electrical resistivity extend southeastward from the LERZ which may be the flow of saline, thermal groundwater from the rift toward the coast, as evidenced in part by the occurence of warm anchialine ponds, thermal infrared anomalies, and warm springs along the coast (see USGS report #100555 & #100557). "Such thermal water may be encountered in the Malami-ki, TH3 [GTW-III] and and MW2 wells" (see USGS report #100557). A USGS report classifies Malama Ki, MW-2, KS-1 and TH3 (GTW-III) as having the same type of hot saline groundwater (see #100550) and acknowledges a possible hydrologic connection between the hot saline groundwater in LERZ or south of the rift, and warm anchialine ponds at the coast (see #100565). PGV's application (see #100855) also states that Malama Ki is "completed in the shallow ground water aquifer and is believed to be potentially downgradient from the project area." Even if Malama Ki were across the groundwater gradient as stated, the HMP indicates a large transverse fault between HPG-A and KS-1A, which could direct groundwater across gradient and toward Malama Ki (see PGV's application #100852, #100856 & #100877).

The most convincing information that EPA has seen regarding Malama Ki being in a separate aquifer is a September 1980 paper on "Mise-A-La-Masse Mapping of the HGP-A Geothermal Reservoir, Hawaii" by James Kauahikaua, Mark Mattice, and Dallas Jackson. Using electrical resistance measurements, it appears that HGP-A is in a compartment of dike-impounded fresh water that differs from the salt-water saturated rock surrounding it. Vertical zones to the northeast and southwest confine the fresh water. These zones are fairly hot and probably represent dike complexes.

Regarding the different tidal effects at Malama Ki and MW-2 indicating that the two wells are in separate aquifers, MW-2 is approximately one mile inland from Malama Ki. So it is expected that tidal effects would be dampened at MW-2 even if the wells are in the same aquifer.

As for GTW-III, EPA questions where the well was purged 3 to 10 times the standing well volume as prescribed in the Hydrologic Monitoring Plan. Such purging before sampling would help eliminate the stratification and thus reduce the chemical constituent variability. Even with the high salinities, there are physical and chemical parameters (e.g. temperature, TDS, pH, chloride ion, dissolved silica, total sulfate, bicarbonate alkalinity, H2S/SO4 and HCO3/CO2) that could be used to monitor for injectate (personnel communication, Kathy Janik, USGS; and PGV comments #600552).

Information that supports the discontinued full-time use of Malama Ki and GTW-III is that no impacts have been detected to date according to the monitoring that has been conducted by PGV under its UIC DOH permit. There is also the question of whether these wells could detect impacts because neither well was completed as a monitoring well.

While there is the question of whether Malama Ki would detect impacts from PGV's activities and there are rectifiable difficulties in collecting samples at GTW-III, EPA believes that these wells could be useful for backup monitoring when situations warrant it. EPA will determine when the backup monitoring wells are used. Situations that would warrant that use included, but are not limited to, leaks in the casing, the migration of fluids between the casing and the formation, and upsets during drilling such as kicks and blowouts.

49.c. Comment: (101.6, 108.64, 108.117) PGV and another commenter wrote that the purpose of the Hydrologic Monitoring Program is to monitor the potential effect of leaking injectant on the USDW surrounding the PGV property. EPA insists on PGV sampling for organochloride pesticide/herbicides and volatile organic compounds (VOC). The PGV injectant does not contain VOCs or pesticides. PGV requests that EPA abandon requiring analyses of groundwater samples for species not found in production fluids. PGV uses n-pentane rather than isopentane.

49.c. Response: Refer to Response 49.b regarding the purpose of the Hydrologic Monitoring Program (HMP). EPA had planned to delete pesticide/herbicide sampling from the HMP and not doing so was an oversight. The final permit does not require sampling and analyses for pesticides/herbicides in the injectate and groundwater.

The final permit does require sampling for volatile and semi-volatile organic compounds in the injectate and groundwater because PGV's produced and thus injected fluids and gases contain these. PGV's application indicated that ethylbenzene, toulene, trichloroethylene, o-cresol and p-cresol had been detected during injectate analyses (see PGV application #100943). PGV did not provide this information in its application, but information collected during the NEIC inspection indicates that benzene has been detected in the produced brine and steam/steam condensate (see NEIC inspection report #400791-400795). Information found in the NEIC report, but not in the permit application, indicates that produced gases, and thus injected gases, contain a number of hydrocarbons including benzene, toluene, ethylbenzene, and xylenes (see NEIC inspection report #400779-400780). The permit deletes sampling for iodide in the injectate and ground water sampling.

The permit requires sampling and analysis for n-pentane in the injectate, rather than isopentane, to acertain that it isn't entering the injectate from the plant. Deleting pesticide/herbicides and iodide, and adding n-pentane is consistent with the 1990 HMP proposal to review the sampling results and either add or delete parameters (see PGV application #100867). EPA will also periodically conduct unannounced sampling, which may include additional analytes, to determine compliance with the condition that only permitted fluids be injected.

- **49.d. Comment:** The Proposed Hydrologic Monitoring Program in Attachment P-3 of PGV's Application, which is based on several years of data, should be used rather than PGV's 1990 Hydrologic Monitoring Program.
- **49.d. Response:** The permit contains a HMP that has elements from the 1990 HMP and PGV's proposed 1996 HMP (refer to Responses 49.c), in addition to some new elements such as using Malama Ki and GTW-III as standby monitoring wells (refer to Response 49.b).
- **49.e. Comment:** (76.1, 160.3) A couple of commentors asked that PGV keep monitoring all the groundwater wells for all the constituents.
- **49.e. Response:** The permit does not require PGV to continue sampling groundwater at Pahoa Battery 2A because that drinking water well is up-gradient of the PGV site. The Kapoho Shaft well is dropped from the monitoring program because earlier monitoring by PGV did not detect any impacts Both the Pahoa Battery well and Kapoho Shaft are County municipal wells that are covered by the State public water supply monitoring, so there will be continued monitoring through that program. As for Malama Ki and GTW-III refer to Response 49.b. The permit requires PGV to keep sampling for the Type I constituents (i.e. inorganics, gases, and field parameters) and adds non-methane hydrocarbons to that list for the reason in Response 49.c. The permit drops monitoring for pesticides/herbicides, but retains monitoring for the other VOCs and semi-VOCs for the reasons listed in Response 49.c.

50. Re: Program for Mechanical Integrity Testing and Monitoring of Injection Wells (II.E.2)

- **50.a. Comment:** (92.25) II.E.2.b. Native Lands Institute commented that EPA representatives should be present during all mechanical integrity testing (MIT). MITs should be performed every six months instead of annually so as to ensure that the wells have mechanical integrity at all time.
- **50.a. Response:** EPA agrees that it should have the option of having a representative witness mechanical integrity testing. Whether a representative is there for every MIT is dependent of budget constraints. Considering that the continuous monitoring of nitrogen pressure will immediately detect

leaks in upper 2,000 feet of the tubing and casing, EPA thinks annual MITs are adequate. The annual MITs check external mechanical integrity (i.e. whether fluid is migrating between the formation and cemented casing), and check the internal mechanical integrity (whether there is a leak in the tubing or casing).

- **50.b. Comment:** (92.26) II.E.2.c. Native Lands Institute commented that the monthly reports should also be submitted to Puna Malama Pono and Civil Defense, as well as real time electronic transfers of data from all monitors. The 24-hour reporting of drops in annulus pressure should also go to Puna Malama Pono and Civil Defense to allow the community to respond quickly should there be contamination of a USDW.
- **50.b. Response:** The quarterly reports and the 24-hour reporting, which is followed by a written report within five days, are public information. EPA will supply that information to Puna Malama Pono or any other member of the public who requests it. The injection pressure for individual wells and annulus pressure is recorded on charts at the well site. The annulus pressure and the injection pressure at the combined flow injection line can be read in the control room of the plant. It should be noted that a drop in annular pressure does not necessarily mean a threat to the USDW. It could be a leak in the tubing as was the case with KS-3. The average hourly injection rates are calculated (see NEIC inspection report #400445). At this point in time, the system is not set up to transfer real-time data outside of the control room at the plant. Unlike air monitoring, EPA does not see the need for real-time UIC monitoring for the reasons expressed in Response 37.b. If someone was using a drinking water well in the near vicinity of the plant, then real-time UIC monitoring data would make more sense, but that doesn't appear to be the case.
- **50.c. Comment:** (108.66) PGV commented that Part II.E.2.a should be deleted as it is already required by Part II.D.1.b. and does not need to be repeated here.
- **50.c. Response:** Requiring implementation of the Program for Mechanical Integrity Testing and Monitoring of Injection Wells in Parts II.D.1.b and Part II.E.2.a does appear redundant. However, mechanical integrity testing is a crucial part of II.D.1 because it helps defines what will be done to determine mechanical integrity. It is also a necessary part of II.E.2, Program for Mechanical Integrity Testing and Monitoring of Injection Wells, because it is the Program for Mechanical Integrity Testing and Monitoring of Injection Wells. In an attempt to reduce redundancy, II.D.1.b. will be incorporated into II.D.1.a. Part II.D.1.c. will become II.D.1.b; and Part II.D.1.d. will become II.D.1.c.
- **50.d. Comment:** (108.67) PGV commented that it is possible that the gas/fluid interface may rise above the base of the USDW for a brief period due to a gas blip or other reason not related to a leak in the hangdown liner or casing. Accordingly, the words, "sustained significant" should be inserted before the word "rise" in the last sentence of this section (c).
- **50.d. Response:** Condition II.D.1.c stipulates that the gas/fluid shall be maintained at a depth of 2,000 feet rather than the base of the USDW (refer Response 43.b for the reasoning behind this). At the April 24, 1996 meeting between EPA, DOH, DLNR, BLM, and PGV, it was suggested that PGV maintain the gas/fluid interface at a depth of 2,500 feet to give PGV a buffer zone should the gas/fluid level rise for reasons other than a leak in the casing or tubing (hangdown liner). PGV maintained that it would be able to keep the gas/fluid interface below 2,000 feet without this requirement. Accordingly, PGV should give itself enough of a buffer so the gas/fluid interface does not rise above 2,000 feet due to gas blips or other reasons not related to a leak in the casing or tubing.

For permit clarity, conditions regarding injection pressure, annulus pressure, and injection rate monitoring from Part II.E.7 have been moved to this part because it addresses those monitoring parameters.

51. Injection Well Performance (II.E.3)

- **51.a. Comment:** (108.68) PGV commented that while it does not object to tracking and providing certain data to the EPA, it should only have to provide data regarding the injection well operation that is required for protection of the USDW. As already discussed in the section above regarding Part II.D.3. Injection Rate Limitations, the only useful parameter with regard to the injection operation and that should be resported is daily maximum and average injection pressure.
- 51.a. Response: In addition to maximum and average injection pressure, the other parameters listed in section help determine compliance with permit conditions designed to protect the USDW or help assess the impacts from leaks. For instance, daily injection rate and total daily injection rate can be used to determine the volume of injectate lost to the USDW should a leak develop. Knowing the volume (quantity) of injectate lost to the USDW or formation assists in estimating if the leak will be detected by monitoring wells. Monitoring and reporting the calcuated minimum annulus pressure required to depress the nitrogen/brine interface below 2,000 feet and the actual daily minimum annulus pressure enables determining compliance with the requirement that the gas/fluid interface be maintained at a depth of at least 2,000 feet. Monitoring and reporting annular pressure is critical in determining if the well has mechanical integrity through the daily monitoring program. According to PGV's application (see #100778), "The nitrogen gas is used to isolate the underground drinking water source from injectate and to monitor for potential casing failure...." A loss of nitrogen pressure following an earthquake is a signal to PGV to shut in the well and check for mechanical integrity (see letter #101606). Because PGV is already monitoring these parameters (maximum and average injection pressures, daily injection rate, total daily injection rate, daily minimum annulus pressure and calculated minimum annulus pressure required to depress the nitrogen/brine interface below 2,000 feet) under its DOH UIC permit, it should not be costly to provide EPA with a copy of this information.

For permit clarity, this entire part which involves reporting is moved to Part II.E.10, Reporting, in the final permit.

In the final permit, iodide has been deleted from injectate (and ground water) monitoring in II.E.3.a because EPA and DOH wanted injectate and ground water sampling to be similar. PGV did not include iodide in its recommended suite of ground water analytes to test for, and EPA and DOH didn't see any reason to keep it.

52. Injection Well Monitoring Program (II.E.4)

- **52.a. Comment:** (108.69) PGV commented that this provision appears to be redundant with other provisions. The entire provision should be located elsewhere; monitoring in Part II.E.6 and reporting at Part II.E.13.
- **52.a. Response:** For permit clarity, the first sentence in this part is deleted because it is repeated in the part on Injection Fluid Monitoring Program, Part II.E.3.a in the final permit. The second sentence regarding Table I of 40 CFR §136.3 and Appendix III of 40 CFR §261 refer to approved test procedures for analyses of injectate constituents. It is combined with Part II.E.4, Injection Fluid Analysis, in the final permit. The third sentence on reporting is moved to Part II.E.10, Reporting, in the final permit.
- **52.b. Comment:** (108.70) PGV commented that the scope of this permit condition is injectate quantity, daily average injectate rate, and injectate pressure. The condition requires PGV to utilized methods specified in Table I of 40 CFR §136.3 or Appendix III of 40 CFR §261. Table I of 40 CFR §136.3 and Appendix III of 40 CFR §261 do not address those parameters. Indeed, there is no Table I in 40 CFR §136.3. There are Tables IA, IB, IC, and ID. Second, the condition requires "Reporting shall consist of a daily record of the injectant quantity being disposed of into each injection well and the daily average injection rate." This either requires a redundant recording of injectate quantity twice or recording of the

same average number for many days. Finally, there is no technical basis related to USDW protection for the tracking and reporting of the injectate quantity and injection rate. They should be deleted.

52.b. Response: Refer to Response 51.a. regarding how injectate quantity and injection rate can be used to assess the impacts to a USDW should a leak develop.

The section originally dealt with sampling and monitoring. The sentence on reporting was added as an afterthought, but will be moved according to the reason listed in the previous response. Table I of 40 CFR §136.3 and Appendix III of 40 CFR §261 do not apply to injectate quantity, daily average injectate rate, and injection pressure, nor were they intended to. Table I, which is specified in 144.52(a)(4) is inclusive of Tables IA, IB, IC, ID, and IE. The final permit will reflect the specific tables that apply to PGV which are: Table 1B, List of Approved Inorganic Test Procedures; Table IC, List of Approved Test Procedures for Non-Pesticide Organic Compounds; and Table IE, List of Approved Radiologic Test Procedures.

"Daily average injection rate" means that there is one data point per 24-hour period starting at midnight. This data point representing the average injection rate should consist of the mathematical mean of 24 actual injection rate measurements. Each injection rate measurement should be taken once an hour since it is expressed in thousands of pounds per hour. Injectate quantity refers to volume. A "daily record" of this means the volume of injectate that is injected during a 24-hour period starting at midnight. For years, PGV has been reporting on both daily average injection rate and injectate quantity (volume) in its injection well performance status reports to DOH, so the meaning of these parameters should not be new to PGV. Part II.E.3. in the draft permit, specifies that PGV "shall follow the same format that has been supplied under the DOH's UIC permit". (That language is slightly modified in the final permit to simplify it.)

53. <u>Injection Fluid Monitoring Program (II.E.5)</u>

- **53.a. Comment:** (108.71) II.E.5.a. PGV commented that this condition concerns injection fluid analysis and more appropriately belongs in Part II.E.6 which addresses injection fluid analysis. The Type I gas parameter samples should be and are taken from the non-condensable gas line prior to mixing with the injectate brine flow, which assures a representative sample.
- **53.a.** Response: The final permit is modified to reflect this.
- **53.b. Comment:** (108.72) II.E.5.b. PGV commented that if the reporting format used in the DOH UIC permit is modified, the EPA report should also be modified. It is unduly burdensome to require PGV to submit two reports in different formats, with the same data. Accordingly, in the first sentence of Part II.E.5.b., "has been" should be changed to "is." Thus, is the DOH format changes, the EPA format follows suit.
- **53.b. Response:** It is EPA's intent that PGV only produce one monitoring report to be supplied to both EPA and DOH. The final permit keeps the requirement that "A monthly report shall be prepared for each well following the same format that has been supplied under the DOH's UIC permit." (The language is simplified to match that in Part II.E.10, Reporting.) Prior to either EPA or DOH changing their reporting formats, both should meet and make sure the change is mutually agreeable.
- **53.c. Comment:** (108.73) II.E.5.b.i. The daily average injection rate is irrelevant to the protection of the USDW and should be deleted. Moreover, "average" is only meaningful when an "averaging period" is specifed which it is not.
- **53.c.** Response: Refer to Response 51.a regarding why daily injection rate is relevant to the protection of the USDW. "Daily average injection rate" was used because that is what has been reported under the

DOH permit for the last six years. The final permit clarifies that daily average injection rate is the arithmetic mean of 24 actual hourly injection rates beginning at midnight.

- **53.d. Comment:** (108.74) II.E.5.b.ii. PGV commented that this section on quantity of geofluids injected should be deleted. Also "geofluid" is an undefined term. The term should be "injectate," which is defined in Part II.D.4.a. Further, the requirement for a summary report is redundant as the quantity of injectate is reported in the monthly report required in 5.b. above.
- **53.d. Response:** Refer to Response 51.a regarding why quantity is required. The term "geofluid" is used in the monthly reports from PGV to DOH to distinguish it from "supplemental water", the quantity of which is also reported. "Geofluid" is a contraction of the term "geothermal fluids" which is defined in permit condition II.D.4.b. as consisting of geothermal brine, geothermal steam condensate, and geothermal noncondensible gases. Part II.D.b.a, which the commentor refers to, limits the injectate is geothermal fluids, supplement(al) water, chemical additions for process system and well casing biofouling, corrosion, and scale control. Including supplemental water in with the term "geofluid" is not appropriate because that term is being used to distinguish it from supplemental water. PGV's application (see #100794-100795) further defines what fluids might be in the supplemental water. The condition regarding the summary report is moved to Part II.E.10, Reporting, in the final permit.
- **53.e. Comment:** (108.75) II.E.5.b.iii. PGV commented that Part II.B.4 sets forth the monitoring devices required to be maintained by PGV. That provision does not require the type of supplemental water monitoring device required under this section (iii). Indeed, there is no way to monitor supplemental water continuously because it comes from many diverse sources. Further, measuring the quantity of supplement water is irrelevant and does nothing to protect the USDW.
- **53.e. Response:** Monitoring the source and quantity of fluids injected into a well is basic information that is required for permit because it enable determining compliance with permit conditions (such as only permitted fluids are injected) and it is important in assessing impacts to the USDW should a leak occur into it. PGV's supplemental water consists of many different types of fluid with different chemical compositions. They can include fluid from the Emergency Steam Release Facility which can contain sodium hydroxide, abatement fluids, Sulfatreat system vaccum pump seal water and condensate drain, and fluids from drilling sumps. It is also important to know this information in the interpretation of sampling results. PGV already reports to DOH the quantity of supplemental water disposed of in the injection wells as measured by a flow indicating and measuring device on the line down-stream of ESRF (see PGV application #100793). Part II.B.4 of the final permit has been revised to include a flow meter for supplemental water.
- **53.f. Comment:** (108.76) II.E.5.b.iv. PGV commented that there is no Chemical Additives Management Plan, nor is one needed. Chemical additive should be monitored in accordance with Part II.D.4.
- **53.f. Response:** Refer to Response 46.b regarding the Chemical Additives Management Plan and why one is required. Part II.D.4 limits chemical additives to those specified in the Chemical Additives Management Plan, whereas this condition, contained under II.E.3.B.iii in the final permit, requires PGV to monitor what additives are being used. Therefore, this condition will remain where it is in the final permit.
- **53.g. Comment:** (108.77) II.E.5.b.vi. PGV commented that Part II.E.5. concerns "Injection Fluid Monitoring Program." Annulus nitrogen pressure is not relevant to injection fluid monitoring. It should be deleted from here.
- **53.g. Response:** Condition in Part II.E.5 requiring the daily average annulus nitrogen pressure and daily average injection rate will be deleted because they are covered in Part II.E.2, Program for

Mechanical Integrity Testing and Monitoring of Injection Wells, and in Part II.E.10, Reporting, in the final permit.

54. Injection Fluid Analysis (II.E.6)

- **54.a. Comment:** (108.78) PGV commented that Part II.E.6 requires periodic sampling of the injectate which doesn't protect the USDW. Sampling should be deleted because of the following reasons. EPA's program does not recognize other "preventive" measures in place at PGV which avoid any impact from injection on the USDW. These measures include well system design, well system leak monitoring features, and pollution prevention activities.
- **54.a. Response:** While well system design and well system leak monitoring features described in the comment help assure compliance with the permit condition that the wells shall maintain mechanical integrity, those measures do not assure compliance with permit condition III.D.4 which specifies that only permitted fluids be injected. Pollution prevention helps achieve that goal, but to determine compliance with that condition, injectate sampling and analyses must be done.
- **54.b. Comment:** (108.79) PGV commented that five years of injectate quality data have shown no excessive levels of any material in the injectate. Indeed, many of the parameters required to be evaluated by EPA have never been found in the injectate. The overall quality of the injectate is generally better than that of the receiving formation fluid. PGV's geothermal operations constitutes essentially a "closed loop" process in which 99% of the fluids injected into the geothermal reservoir are composed of the same naturally occurring fluids removed from the reservoir. Moreover, many of the "contaminants" found in the reservoir are naturally occurring, such as lead and arsenic.
- **54.b. Response:** EPA requires that some parameters, which might not be anticipated to be found, be monitored to determine that only permitted fluids are being injected. The final permit does not require sampling for pesticides and herbicides. Refer to Response 41.c regarding the modified sampling plan. While the injectate might be generally better than the receiving formation, which is not a USDW, it may not be better than the USDW that the injection well passes through. The fact that many contaminants, such as lead and arsenic, occur in the injectate is an additional reason to monitor the injectate. Should a leak occur in the injection wells, piping, or production wells, then the system is no longer a closed loop.
- **54.c. Comment:** (108.80) PGV commented that many of the parameters required by EPA to be monitored are RCRA Hazardous Waste. The overwhelming majority of these materials are not generated at PGV. PGV is a conditionally exempt small quantity generator as defined in 40 CFR §261.5. Even if they were present at PGV, EPA has exempted geothermal fluid from the definition of hazardous waste (40 CFR §261.4[b][5]). Accordingly, requiring costly monitoring of materials that are not used at the facility and which in any event are excluded from regulations under RCRA is unreasonable and unnecessary.
- **54.c. Response:** The fact that PGV is a small quantity generator means that PGV is exempted from certain RCRA requirements. This does not exmpt PGV from the Safe Drinking Water Act requirements. While certain geothermal fluids associated with the production of these fluids are exempted from federal RCRA requirements, they are still subject to Safe Drinking Water Act requirements. In the past, EPA has enforced against one power plant on the Island of Hawaii for illegally discharging a solvent used for equipment degreasing into an injection well. It is typical of power plants to have paint thinner and equipment degreasers on site. To assure that these types of fluids not being illegally disposed of in the injection wells, the injectate needs to be monitored for chemicals that may be classified as RCRA hazardous waste. Additionally, the State Hawaii has chosen not to exempt geothermal fluids from the State RCRA program. The County of Hawaii also requires proper disposal of hazardous waste (see #200382-200383).

- **54.d. Comment:** (108.81) PGV commented that it is extremely costly and inefficient to require PGV to perform quarterly and semiannual monitoring to determine compliance with chemical limitations in the permit. Obviously, if PGV wanted to evade compliance, which it does not, it could easily dispose of unlawful materials when monitoring was not occurring. The efficient path to USDW protection is preventing materials from entering the USDW in the first place which is the plan PGV proposed in Attachment P-4 of the application (i.e. maintain mechanical integrity and eliminate injectate sampling and analysis). Finally, if EPA insists on using injectate monitoring to insure compliance with permit chemical limitations, it should use its authority to monitor PGV's injectate itself at any time to confirm that only the allowed fluids are being injected.
- **54.d. Response:** EPA and DOH have reduced the cost of PGV's injectate monitoring program by reducing sampling frequency by 50% based on the results of previous monitoring. However, injectate sampling will not be entirely eliminated as PGV proposes. EPA requires injectate sampling and analysis with sufficient frequency for wells that inject below the USDW in order to yield data representative of the injected fluids (40 CFR §§144.28(g)(1)(i) and 144.52(a)(9)). EPA will conduct surprise sampling inspections to independently confirm the composition of the injectate and compliance with the permit.

55. Re: Injection Fluid Monitoring Data (II.E.7)

- **55.a. Comment:** (108.82) PGV notes that no UIC permit of which PGV is aware requires injectate monitoring at this level. There is no evidence that PGV's current monitoring programs are not fully protective of the USDW or that any additional requirements proposed by EPA offer additional protections to the USDW. PGV suggested that the injection fluid monitoring table be modified to: exclude injection rate; change visual observations to 1-4 times daily; and change temperature monitoring to visual observation.
- **55.a. Response:** DOH's UIC permit to PGV requires monitoring and reporting at this level. EPA has issued to another facility in Hawaii a Class V permit that requires similar continuous monitoring of the injection rate with flow meter. There is no annular pressure monitoring at that facility because the approximately 200-foot wells do not have annuli; and there is no injection pressure monitoring because injection does not occur under pressure but by gravity flow. There is no basis for PGV to compare its permit to others because facilities differ and permit conditions are established on a case-by-case basis (40 CFR §§144.52[a] and 144.52[a][9]). As for PGV's current monitoring programs being protective, PGV's Casing Monitoring Program is dependent on the monitoring of the parameters in II.E.7 to be effective. Eliminate monitoring for these parameters and the effectiveness of the program is eliminated (refer to Responses 51.a and 37.f-h for why these parameters should be monitored). The information in the table in II.E.7 has been moved to the sections of the permit pertaining to the monitoring of the individual parameters. Injection rate monitoring is retained for the reason in Responses 37.f and 51.a. "Daily" has been substituted for "4 X/day" and that encompasses "1-4 X daily". Visual temperature observations are approved because there is just a temperature indicator at the well.
- **55.b. Comment:** (108.83) PGV commented that digital recording devices are neither required by Part II.B.4 nor currently in use at PGV. In addition, they are prohibitively expensive and burdensome. There is no permit limitation of the injection rate. Accordingly, no injection rate data is necessary and this requirement should be omited.
- **55.b. Response:** For reasons as to why injection rate is monitored, refer to Response 37.f and 51.a. The final permit does not include digital recording of data because the information is recorded graphically.
- **55.c. Comment:** (108.84) PGV commented that with continuous recording devices, it is not necessary to visually observe four times per day unless a potential problem with the device or the well has been identified. An absolute requirement of four times per day is unduly burdensome for PGV.

- **55.c. Response:** EPA inserted four visual inspection per day into the permit, because when EPA asked PGV at the April 24, 1996 meeting how many times a day did they visually checked the gauges at the wells, a PGV's representative replied four. The final permit is modified to require PGV to visually check these parameters daily.
- **55.d. Comment:** (108.85, 162.9) PGV and DLNR asked why continuous monitoring of the injectate temperature by a graphical chart is needed. In conjunction with the restriction on the quantity of injectate fluid, how will the continuous recording of such information be effectively used to minimize contaminant related impacts. As noted in Part II.A.4.e., a continuously recording temperature recorder is neither necessary for the protection of the USDW nor currently in use by PGV. A temperature indicator on the injection line upstream of each wellhead is sufficient. In this case the monitoring frequency would not be continuous, rather it should be by visual oberservation one to four times per day.
- **55.d. Response:** The commenter must be refering to Part II.B.4.e because there is no II.A.4e. Knowing the temperature of the injectate is critical in determining external mechanical integrity with a temperature log. If a leak develops that causes injectate enters the USDW, knowing the temperature of the injectate will facilitate looking for on the temperature logs. If a leak was large enough and the temperature differential between the injectate and the groundwater was great enough, the leak might be detected in a nearby monitoring well. The temperature of the injectate is also a critical piece of information during injectate sampling. Because temperature is monitored with an indicator (e.g. gauge) and not with a continuous graphical chart, the permit is modified to reflect this practice. Refer to Response 51.a as to why quantity is monitored and there is no "restriction on the quantity of injectate fluid" in the permit.
- **55.e. Note:** In response to the comment on permit clarity and organization, this Part on Injection Fluid Monitoring Data will be deleted because injection pressure, annulus pressure, and injection rate monitoring conditions are combined with their respective monitoring conditions in Parts II.B.4, Monitoring Devices, and II.E.2, Program for Mechanical Integrity Testing and Monitoring of Injection Wells, in the final permit. Temperature monitoring is moved to Part II.E.3, Injection Fluid Monitoring Program, to be combined with the temperature monitoring condition in that part of the final permit.

56. Re: Calibration of Monitoring of Equipment (II.E.8)

- **56.a. Comment:** (92.27) Native Lands Institute commented that PGV should be required to certify when calibration is happening on schedule. A one-time report on the planned procedures won't ensure that those plans are carried out.
- **56.a. Response:** This permit condition, which is moved to II.E.6 in the final permit, requires that all monitoring and recording equipment be calibrated on a regular basis. EPA will assess PGV's report describing the calibration procedures. During compliance inspection, EPA can check to see if PGV is regularly calibrating their monitoring and recording equipment.
- **56.b. Note:** For the logical sequence of conditions, this part follows Part II.E.5, Monitoring Information, in the final permit.

57. Re: Automatic Alarms and Shut-Off Devices (II.E.9)

- **57.a. Comment:** (108.35) PGV commented that other than the computer printout which visually and audibly alerts the operator, no additional visual or audible alarms are necessary or appropriate.
- **57.a. Response:** In the draft permit, EPA required visual and audible alarms should overpressurization occur on the combined flow injection line because PGV's application material stated that it already had these alarms. A PGV letter (see #101096) stated that there was "an injection pressure switch that

triggers visual and audible alarms in the control room as well as a computer printout" and "There are both visual and audible alarms for the actuation of the pressure (PSH 4157) switch in the control room. This also includes a printout from the computer any time the switch is activated." Jack Dean of PGV later explained that the sound and sight of the activated computer printout were the visual and audible alarms (personnel communication, Jack Dean, PGV, General Manager and Vice President).

On checking with other agencies, EPA has determined that actual alarm systems are used when injection operations are in areas remote from the control room. Because PGV's injection operations are relatively near the control room, the final permit requires that PGV keep the computer printout "alarm" which it currently has. The telemetering systems that the commenter refers to must be the monitoring of the injection pressure in the control room. The permit retains that condition because 1) PGV is already doing this, and 2) monitoring injection pressure in the control room can alert operators to instances of overpressurization which, if not mitigated, could cause fluids to migrate out of the injection zone into the USDW by increasing the pressure in the injection zone and possibly fracturing the formation.

- **57.b.** Comment: (92.28) Native Lands Institute commented that the information being fed into these devices should be electronically transmitted to Puna Malama Pono in real time.
- **57.b. Response:** While this information is important in monitoring potential impacts to the USDW, there is no immediate endangerment to human health from the pressure in the combined injection flow line exeeding 470 psig. Therefore, EPA does not think it is necessary to require PGV make real-time monitoring of this information available to an outside entity. However, it is important to know when the injection pressure has increased to a point that it causes the relief valve to open because this indicates that the injection pressure is approaching the injection pressure limitation. Therefore, under 40 CFR §144.52(a)(9), the final permit requires any excedence of 470 psig on the combined flow injection line to be reported in the quarterly injection well performance status reports. This is public information under §144.5 and is available to any member of the public on request.
- **57.c. Comment:** (108.86) PGV commented that when the same requirements are set forth in multiple sections but with different language, it simply increases the chances of inconsistencies and confusion. This is the case in this section as 9.a requires "daily" visual checks, while Part II.E.7 requires visual checks four times per day.
- **57.c. Response:** "Daily" visual checks means multiple checks within a 24 hours period which includes visual checks four times per day. The final permit requires visual checks daily. The condition requiring visual checks of the injection pressure, injection rate, and annulus pressure has been moved to II.E.2.c which covers the mechanical integrity monitoring program; and the condition requiring visual checks of temperature has been moved to II.E.3.iv which covers the injection fluid monitoring program.
- **57.d. Comment:** (108.88) PGV commented that regarding II.E.9.a, the use of "combined brine reinjection line" should be "combined injection line". The activation of the pressure switch on the conbined injection line triggers the computer printout, which along with numerous readouts, alerts the operators as to the potential over-pressure situation. There is no device that directly alerts the operators that the relief valves at the wells have been activated.
- **57.d. Response:** Refer to Response 23.a as to why "combined brine reinjection line" was used in the draft permit. The draft permit does not refer to a relief valve on the combined flow injection line, but rather "the relief valves on the individual injection wells". EPA is also aware that the relief values at the individual wells are set at 500 psig and the presure switch on the combined flow injection line is set at 470 psig (see letter #101096). The permit does not require a device to notify the operators that the relief valve has been activated, but it does require that the pressure switch and relief valves shall be maintained in good working order and set so as to not cause an excedence of the injection pressure for the individual wells or the fracture pressure of the formation.

- **57.e. Comment:** (108.87) PGV commented that provisions dealing with operations and maintenance in 9.b and 9.c are covered in Parts III.E.5 and II.B.4. The first sentence of III.E.9.b is covered by Part III.E.5. The second sentence of II.E.9.b. is covered by Part II.D.2.a. Moreover, the injection pressure for each well has been established so as to stay below the fracture pressure of the formation. Thus, the second part of the second sentence is not relevant.
- **57.e. Response:** The first sentence of II.E.9.a regarding visually checking injection and annulus pressures has been moved to II.2.c (Program for Mechanical Integrity Testing and Monitoring of Injection Wells). The first sentence of II.E.9.b has been moved to III.E.5 (Proper Operation and Maintenance). The pressure switch, relief valves and manual block valves, referred to in 9.b. and 9.c. do not readily fit under II.B.4 (Monitoring Devices). In the final permit, II.E.9.b regarding the pressure switch and relief valves is located under II.D.2.b (Injection Pressure Limitation). The second sentence of II.E.9.b, which refers to the setting of valves and switches, fits better under II.D.2.b, which discusses maintanence of equipment, rather than II.D.2.a, which specifies injection pressure limitations. Part II.E.9.c regarding the manual blocks to close the injection wells belongs where it is under Automatic Alarms and Shut-Off Devices, which is renamed II.E.7 in the final permit.
- **57.f. Comment:** (108.89) PGV commented that maintenance of valves on the injection wells are covered by Part III.E.5, and controls on production wells are prohibited in a UIC permit. Thus, this section (c) should be omitted.
- **57.f. Response:** Even though Part II.E.5 covers proper operation and maintenance in general, the ability to shut in the injection wells is important enough to warrant its own condition under Automatic Alarms and Shut-Off Devices, which is renamed Part II.E.7 in the final permit. In the final permit, the reference to production wells is deleted for the reasons stated.

58. Re: Monitoring Information

58.a. Note: For permit clarity and the logical sequence of conditions, this part is moved to follow Part II.E.4 (Injection Fluid Analysis) in the final permit and becomes Part II.E.5. To clarify the results of analyses, EPA is adding requiring reporting units to condition II.E.4.g, analyses results, because some laboratory reports do not include the reporting units.

59. Recordkeeping (II.E.11)

- **59.a. Comment:** (108.90) PGV commented that its records are voluminous and it has limited document storage space at the facility. PGV should be permitted to retain the records off-site in an appropriate document storage facility. At such time as EPA desires to review such records at the facility, the records can be removed from storage and delivered to the facility for inspection.
- **59.a. Response:** It is important that EPA have immediate access to records at the facility. EPA will be conducting unannounced inspections and due to travel arrangements, EPA may only have a few hours at the facility. If PGV has to retrieve records from an offsite location, such as Hilo, this could take hours and could preclude EPA from having access to the records. After retaining a record generated by this permit for the amount of time specified in 40 CFR §144.51(j), PGV has the option of sending the records to EPA for storage.

60. Re: Reporting of Results (II.E.13)

- **60.a. Comment:** (92.29) Native Lands Institute requested that all submissions of data in this section should be submitted to Puna Malama Pono in addition to EPA.
- 60.a. Response: This is public information under 40 CFR §144.5 and is available to any member of the

public who requests it.

60.b. Note: II.E.13(a). In response to the comment on permit clarity, the schedule for submitting the semiannual groundwater monitoring data is included in the final permit. The April 1990 Puna Geothermal Venture Hydrologic Monitoring Program stipulates that the reports are due February 15 and August 15 of each year.

60.c. Comment: (108.91) II.E.13(b). PGV commented that notifying EPA 45-day in advance of MITs is unreasonably long. Given consultants schedules, 30 days would be reasonable.

60.c. Response: The 45-day notification period for annual MITs is consistent with the 45-day notification period for plugging and abandoning wells. The 45 days is necessary to give EPA enough advance notice to make travel arrangements for EPA personnel and representatives from other agencies. Advance notification is especially important because PGV has repeatedly ignored EPA's written and verbal requests that PGV notify EPA when MITs occur so that an EPA representative can witness them. For example, on October 31, 1997, EPA sent PGV a letter requesting to be notified of when PGV's next round of MITs would be so an EPA representative could observe them (see letter #101579). This was prompted by a letter from PGV to DOH that stated that the October MITs were delayed, but would be done before the end of the year (see letter #102752). On November 11, 12, and 13, 1997, Jack Dean (PGV) left messages for Shannon FitzGerald (EPA), but did not say when the MITs would be done (see record of communication #101587). On November 13 and 19, 1997, Shannon FitzGerald left messages for Jack Dean asking when the MITs would be done (see record of communication #101587). On December 3, 1997, Jack Dean called EPA to say that the MITs were done November 3, 1997, the day PGV received EPA's letter. He said that Peggy Stover-Catha (Constellation Energy, Inc.) had told him that Shannon FitzGerald had left a couple of messages for him. He said that there must have been a problem with the answering maching (see record of communication #101613).

On an August 24, 1998 telephone call, Shannon FitzGerald asked Jack Dean when the next round of MITs would be. Jack Dean said that they just completed the annual shutdown for maintenance and PGV did all of MITs then. Jack Dean said that in the past PGV didn't test all the wells all at once due to a wire malfunction (see record of communication #102831). During an October 2, 1998 telephone call, Chauncey Hew (DOH) said that he had not been notified of the MITs, nor had he received any results (see record of communication #102834). Then during a December 1, 1998 telephone call from Jack Dean to Shannon FitzGerald. Jack Dean said that about three weeks earlier PGV had done its MITs (see record of communication #102933). This was contrary to what he had said on August 24, 1998--that PGV had done all of its MITs in August. Earlier that day, Shannon FitzGerald had asked Chauncey Hew about PGV's MITs. Chauncey Hew said he'd check, but he thought PGV did its MITs in November (see record of communication #102933). The 1998 MIT test results, which were sent to DOH on April 15, 1999 show that only a shut-in temperature survey on KS-4 was conducted in August, 1998 (see letter #301857-301902). MITs were not done for KS-1A and KS-3 until November, 1998 (see letter #301858-301885 & #301886-301902). KS-4's casing pressure tests was not conducted until December 10, 1998--nine days after Jack Dean had told Shannon FitzGerald that PGV had already done its MITs in November (see letter #30170-301885).

In order to make reporting requirements clearer, a condition will be added that the resulting report and supporting data will be provided to EPA within 60 days of the tests. The permit (Appendix D, Casing Monitoring Program, #103024-10331) also stipulates that the annual MITs shall be done in November, when they are usually conducted. If PGV conducts the MITs without notifying EPA 45 days in advance, EPA will have PGV redo the MITs in the presence of an EPA representative.

60.d. Comment: (108.92) II.E.13(c). PGV commented that as previously stated in Parts II.B.3 and II.B.5, references to well conversions and alterations should be deleted.

- **60.d. Response:** Refer to Responses 36.a and 38.b regarding well conversions and alterations. In addition to specifying II.B.5 and II.D.1, the permit is modified to also include II.B.3 and II.B.6 which also pertain to reporting on changes, workovers, and well conversions.
- **60.e. Comment:** (108.93) II.E.13(d). PGV commented that the permit does not require any "calibrations required for the other reports." Accordingly, this phrase should be deleted.
- **60.e. Response:** The one-time report in Part II.E.8 describes calibration procedures. The reference to calibrations required for the other reports covers actual calibration results that may be done in conjunction with reporting under this permit. For instance, a report on non-compliance might include calibration results if the calibration was in question.
- **60.f. Comment:** (108.94) II.E.13(e). PGV made the comment that the reference to Part II.E.4 should be to Part II.E.3. PGV stated that the quarterly injection well status report submitted to DOH under the State UIC permit does not require narrative descriptions and explanations of all noncompliance that has occurred. PGV considers it unduly burdensome for PGV to supply EPA with a report on noncompliance when DOH does not require this.
- **60.f. Response:** In response to PGV's comment on clarity and organization, all of II.E.3. and the last sentence of II.E.4 are incorporated into II.E.13(e), which is relabeled II.E.10.e in the final permit.

As to PGV's comment that it does not want to report on noncompliance with the EPA permit in the quarterly reports, EPA notes that reports of noncompliance are mandatory under UIC regulation in 40 CFR §144.51 "Conditions applicable to all permits". Specifically, §144.51(I)(7), regarding "Other noncompliance", states that "[T]he permittee shall report all instances of non-compliance not reported under paragraphs (I)(4), (5), and (6) of this section, at the time monitoring reports are submitted. The reports shall contain the information listed in paragraph (I)(6) of this section." In response to PGV's comment on permit clarity, EPA references this regulation in the final permit. PGV can still submit the same quarterly report to EPA and DOH, which includes a section titled "Noncompliance with the EPA Permit". DOH will know that this does not apply to the State permit.

- **60.g. Comment:** (108.95) II.E.13(f). PGV objects to the condition that it report "all non-compliance" orally within twenty-four hours and in writing within five days. PGV assumes that this includes twenty-four hour oral notification of any minor, technical noncompliance with the permit, such as the late filing of a monitoring report. PGV claims that setting up a system to ensure 24-hour notification would cost thousands of dollars and is unduly broad. According to PGV, the UIC regulations at 40 CFR §144.51(I)(6) impose this obligation only for "noncompliance which may endanger health or the environment." PGV states that it is already required by Part II.E.17 to provide twenty-four hour oral reporting of noncompliance which might endanger USDW's. PGV thinks that Part II.E.17 fully addresses the 24-hour reporting requirements and those requirements should not be repeated in II.E.13(f).
- **60.g. Response:** In the final permit, the reference to all noncompliance is dropped because 40 CFR §144.51(I)(6) does not support the 24-hour reporting of all noncompliance. Instead, this condition refers to the section on Twenty-Four Hour Reporting (II.E.13 in the final permit) for any noncompliance which may endanger USDWs, human health or the environment. It should be noted that quarterly reporting of all noncompliance is still required in the final permit as discussed in Response 60.f.
- **60.h. Comment:** (108.96) II.E.13(g). PGV made the comment that the items set forth in (g) have nothing to do with the reporting of results which is the subject of Part II.E.13. It claims that the requirements to submit the data requested in (g) are adequately provided for elsewhere in the permit.
- **60.h. Response:** While EPA agrees the information required in II.E.13(g) can be located elsewhere, not all of the information in II.E.13(g) is adequately provided for elsewhere in the permit. Therefore, the

final permit has been modifed to include the requirements of providing the following information for new wells: well pad location and area of review in II.A.2.b; and the maximum injection wellhead pressure in II.D.2.a;

60.i. Note: In response to the comment on permit clarity and organization, Parts II.E.13(e) and II.E.13(h) are combined in the final permit because each report is submitted quarterly.

61. Re: Modifications to Monitoring and Reporting (II.E.14)

- **61.a. Note:** In response to PGV's comment on permit clarity and organization, this part is combined with Modification to Monitoring Programs and becomes Part II.E.11 in the final permit.
- **61.b. Comment:** (92.30) Native Lands Institute made the comment that Puna Malama Pono should be informed of any modifications to the monitoring and reporting conditions of the permit.
- **61.b. Response:** EPA notes this request and will provide this information to Puna Malama Pono or any other member of the public who requests it. If the modification to monitoring and reporting requires more frequent monitoring or reporting by the permittee, then this would be a minor modification of a permit under 40 CFR §144.41(b), which would not require public review and comment on the modified permit. Any other modification, with the exception of those listed in §144.41, would require drafting a new permit and public notification and review of the new permit, with the option of a public hearing. In the case of a modified permit, only the condition subject to modification would be reopened. If the entire permit were revoked and reissued, then the entire permit would be subject to review and comment.

62. Re: Modifications to Monitoring Programs (II.E.15)

- **62.a. Note:** For permit clarity, this part is combined with Modification to Monitoring and Reporting and becomes Part II.E.11 in the final permit.
- **62.b. Comment:** (92.31) Native Lands Institute made the comment that Puna Malama Pono should be informed of any modifications to the Hydrologic Monitoring Programs or the Production and Casing Monitoring Program.
- **62.b. Response:** Refer to Response 61.b.

63. Re: Additional Monitoring and Reporting (II.E.16)

- **63.a. Comment:** (108.97) PGV made the following comments regarding Part II.E.16, which states that adherence to the monitoring and reporting conditions of such other pollution control programs shall not be circumented by the terms and conditions of this permit. PGV's interpretation of the condition is that it cannot circumvent the requirements of other pollution control programs because of compliance with this permit. PGV wonders how it can comply with this and what if a requirement of another pollution control program were in direct conflict with a requirement of the UIC permit? PGV states that Section II.E.16 does not provide PGV with notice of the statutes and regulations which fall within other pollution control programs. This condition is similar to one in the DOH UIC permit and EPA can only use it if it is authorized by statute and protects USDW's.
- **63.a. Response:** EPA is authorized to include this permit condition under 40 CFR §144.52(a), the section on establishing permit conditions. Section 144.52(a) states that "In addition to conditions required in §144.51, the Director shall establish conditions, as required on a case-by-case basis under...§144.54 (monitoring)...."

PGV is correct in its understanding of the permit condition, which mandates that PGV does not

circumvent the monitoring and reporting requirements of other pollution control programs by complying with this permit. For PGV to accomplish this, all PGV has to do is follow the reporting and monitoring requirements

of other pollution prevention programs. Pollution control programs include, but are not limited to programs under the Safe Drinking Water Act (SDWA), the Clean Water Act (CWA), the Clean Air Act (CAA), the Resource Conservation and Recovery Act (RCRA), the Emergency Planning and Community Right to Know Act (EPCRA), and State and County laws and regulations. For permit clarity, the final permit elaborates on what programs are covered by the term pollution prevention programs. EPA knows of no instance where reporting and monitoring for another program would be in direct conflict with the requirements of this permit. PGV is currently required to comply with a similar condition in the DOH UIC permit.

64. Re: Twenty-Four Hour Reporting (II.E.17)

- **64.a. Note:** In response to Comment 60.g, the language in II.E.17, which is renamed II.E.13, is modified in the final permit to reflect the language in 40 CFR §144.51(I)(6), the section on twenty-four hour reporting.
- **64.b. Comment:** (92.32) Native Lands Institute made the comment that the 24-hour oral report and the five-day written report should also be submitted to Puna Malama Pono. Releases of hydrogen sulfide should be added to the list of event which trigger the 24-hour reporting.
- **64.b. Response:** EPA notes this request and will provide this information to Puna Malama Pono or any other member of the public who requests it. Whereas a loss of mechanical integrity would be reported to EPA, releases of hydrogen sulfide that exceed certain standards would be report to DOH under its Noncovered Source Permit to PGV. Puna Malama Pono should contact DOH for that information.
- **64.c. Comment:** (108.98) II.E.17(b). PGV commented that fluid cannot migrate "between a USDW" and the language should be modified to state only geothermal injectate fluid rather than fluid.
- **64.c. Response:** The final permit has been modified to read "into a USDW or between USDWs." Rather than modifying the permit to specify just geothermal injectate fluid, EPA will keep the general term "fluid" because 40 CFR §144.51(l)(6)(ii) states "Any noncompliance with a permit condition or malfunction in the injection system which may cause fluid migration into or between USDWs." In addition to this being the language in the regulations, PGV has stated in its comments on the draft permit and application says that not all of the injected fluids are geothermal fluids. Other injected fluids include stormwater, rinsate from the water softener system, water used for cooling the sulfatreat system, steam turbine seal water, abatement fluids, among others. The regulations also use the term "fluid" to address situations where injected fluids could cause the migration of formation fluids into USDWs. An example of this is §146.6(a)(ii) which specifies "may cause the migration of the injection and/or formation fluid into an underground source of drinking water".
- **64.d. Comment:** (108.99) PGV commented that an injection well cannot overflow and the Emergency Steam Release Facility (ESRF) is not part of the the injection system and therefore cannot be regulated. So the entire sentence should be deleted.
- **64.d. Response:** Even though injection wells can and do overflow, EPA will clarify the language in the final permit by using the term "wellhead leaks" rather than overflow. As for the ESRF not being part of the injection system, the ESRF collects and contains fluids prior to sending them directly to the injection wells. Any overflow or leak in the ESRF would allow fluids intended for injection to be disposed of directly on the ground which could be a violation of section 1431 of the SDWA.
- **64.e.** Comment: (108.100) PGV commented that it may not be able to fully analyze and report on the

cause, anticipated duration, and mitigation of incident within the five days, in part because because many of its consultants are on the mainland.

64.e. Response: 40 CFR §144.51(I)(6) specifies that a written report shall be submitted within five (5) days. PGV was able to provide HDOH a written report on the cause of the leak in KS-3 within three days. While PGV may not have all of the information within that time period, PGV is required to provide sufficient information within the five day period and to submit additional information as it becomes available.

65. Re: Reporting of Noncompliance of Permit Limitations (II.E.18)

- **65.a. Comment:** (92.33) Native Lands Institute comment that PGV should not be relied upon to give accurate information about instances of noncompliance due to its interest is in maintaining operations, which may run counter to public health interests. They suggest all data from monitors should be transmitted to EPA and Puna Malama Pono in real time.
- **65.a. Response:** In determining PGV's compliance with the permit, EPA will compare raw monitoring data to reports submitted to EPA. If EPA finds discrepancies, they could result in enforcement and possible imposition of a real-time data provision. Accordingly, EPA does not require data to be transmitted to EPA and Puna Malama Pono in real-time.
- **65.b. Comment:** (108.101) PGV commented that this condition does not specify the noncompliance to which it refers. The word "conditions" should be substituted for the word "limitations". The five day time period in which to file the report is too short and should be modified to read "within five (5) days or as soon thereafter as is reasonably practicable under the circumstances."
- **65.b. Response**: Part II.E.18 states "The permittee shall notify the EPA of any exceedances of or noncompliance with limitations (i.e. conditions) contained in this permit." The permittee must report noncompliance with all limitations and conditions in the permit and the final permit is modified to clarify that. Both terms are included because a limit, such as a maximum injection pressure limitation, is different from a condition, such that the permittee shall maintain a financial assurance mechanism. Part II.E.18 goes on to provide examples of permit limitations which include injectant pressure, annulus pressue, injectant chemical concentrations, physical parameters, chemical additives, and scheduled events such as analyses, evaluations and reports. Regarding the reporting period, the final permit is modified to include language from 40 CFR §144.51(I)(7), the section on other noncompliance, which requires that all instances of noncompliance be reported in monitoring reports, in this case quarterly monitoring reports, if they are not covered by twenty-four hour reporting, other monitoring reports or compliance schedules.

66. Re: Notice of Plugging and Abandonment (II.F.1)

- **66.a. Comment:** (162.10) DLNR commented that the wells referred to in this section need to be clearly identified as injection wells to preclude confusion with the requirements for production wells.
- **66.a. Response:** EPA will add language to the permit clarifying that the term "well" as used in the permit refers to an injection well unless otherwise stated.
- **66.b. Comment:** (92.34) Native Lands Institute commented that Puna Malama Pono should also be informed of conversion, workover, or abandonment of wells no less than 45 days before such work occurs, and allowed to have a representative witness the plugging and abandonment of wells.
- **66.b. Response:** EPA will notify Puna Malama Pono and any other member of the public who requests to be notified of conversions, workovers, and well abandonments as soon as EPA learns of these.

Whereas EPA has regulatory ability to be on site when the plugging and abandonment of wells occurs, Puna Malama Pono would need the permission of PGV to be on site to witness well plugging and abandonment.

- **66.c. Comment:** (108.102) PGV commented that this condition should read "The permittee shall notify the EPA no later than forty-five (45) days before abandonment of a well." Conversions and workovers are treated in Parts II.A.2 and II.B.5 and are not applicable here.
- **66.c. Response:** In the final permit, references to conversions and workovers are deleted from II.F.1 and moved to II.B.5 (workovers) and II.B.6 (the new section on conversions).

67. Plugging and Abandonment Plan (II.F.2)

- **67.a. Comment:** (108.103) PGV objects to being required to comply with new conditions that may be required by the state and county, which could conflict with the plan approved by EPA. The reference to other agencies' requirements should be deleted.
- **67.a. Response:** PGV's Plugging and Abandonment Plan should already comply with State and County requirements because PGV is required to do this under State and County regulations. The final permit contains language that addresses the situation where a new State or County plugging and abandonment requirement arises that is not included in the current Plugging and Abandonment Plan submitted to EPA. In accordance with §§144.52(a)(9), 144.28(c)(ii), 144.28(j)(2), the permit reads "The permittee shall submit any proposed significant revision to the method of plugging reflected in the plan no later than 45 days prior to well plugging and abandonment." Condition II.F.3 regarding the plugging and abandonment report, which is based on §144.51(p)(2), also takes into account the situation where plugging and abandonment procedures may differ from the plugging and abandonment plan. Amending a plugging and abandonment which has been updated under §144.52(a)(6) is a minor modification under §144.41(g).

68. Plugging and Abandonment Report (II.F.3)

- **68.a. Comment:** (92.35) Native Lands Institute commented that reports should also be submitted to Puna Malama Pono.
- **68.a. Response:** Plugging and abandonment reports submitted to EPA are public information under 40 CFR §144.5, and are available to the public upon request.

69. Cessation of Injection Activities (II.F.4)

- **69.a. Comment:** (108.104) PGV commented that this condition should not restrict it from using inactive injection wells for monitoring wells. It would provide useful information while having no effect on the protection of the USDW.
- **69.a. Response:** Application material shows that PGV currently uses the existing injection wells to monitor shut-in downhold pressure. This section has been renamed "Well Closure" and modified to require that any injection well used for monitoring purposes shall be properly plugged and abandoned once the monitoring is completed. In order to protect the USDW, mechanical integrity still has to be demonstrated (refer to Response 43.f) and financial assurance maintained (refer to Response 70.e) for injection wells used for monitoring purposes.

70. Re: Demonstration of Financial Responsibility (II.G.1)

70.a. Comment: (92.36) II.G.1.a. A commenter asked how was it determined that \$417,200 was

adequate to ensure that the three exisitng wells are properly plugged and abandoned? The commenter believes that this amount is grossly inadequate to plug and abandon even one well. If these wells are not plugged and abandoned properly, whose responsibility is it to see that they are properly dealt with? The permit does not address this. Whose responsibility is it to cope with accidents in the near and far future from plugged and abandoned wells that negatively impact the residents and farms of Puna?

70.a. Response: PGV's consultant, Bob Verity who was with the Mesquite Group, provided the cost breakdown of closing three existing injection wells (see #101554-101555). EPA had an independent expert, Joe Hughes of the U.S. BLM, review the projected cost (see #101639). Mr. Hughes concluded that a bond of \$417,200 was enough to close the three wells. If the three wells were closed at the same time rather than separately, there would be extra funds.

If the wells are not properly plugged and abandoned, EPA can pursue enforcement for noncompliance with the permit. DOH also has a condition in their permit regarding proper closure, as does DLNR in §13-183-82(b) of its geothermal drilling and leasing regulations which states "The operator of a lease shall promptly plug and abandon any well that is deserted or not used or deemed useful by the board."

Under Section 1431 of the Safe Drinking Water Act, EPA can issue an emergency order to close abandoned wells "upon receipt of information that a contaminate which is present in or is likely to enter a public water system or an undergound source of drinking water may present an imminent and substantial endangerment to the health of persons, and that appropriate State and local authorities have not acted to protect the health of such persons, may take such action as he may deem necessary in order to protect the health of such persons." There is similar authority under the Clean Air Act regarding air emissions that could be applied to abandoned wells. EPA's Emergency Response Program was involved in plugging abandoned production and injection wells in the Geysers Field in California when leaking hydrogen sulfide from the wells presented an endangerment.

- **70.b. Comment:** (92.37) II.G.1.b-c. A commenter said that the "periodic" update of the Plugging and Abandonment Plan and Costs associated with it should be completed annually, and the demonstration of financial responsibility should reflect all projections of increased costs, but no decreasing projections (because decreases are more likely to be due to temporary market fluctuations, while increases may be caused by inflation, which is not likely to reduce cost in the near future.)
- **70.b. Response:** EPA will retain the flexibility to require a periodic update of the Plugging and Abandonment Plan and associated costs rather than requiring an annual one. EPA would not require that the financial assurance mechanism to be modified until the reassessed cost was greater than ten percent of the most recent estimate, thus it would probably take a few years for this to occur with inflation. In the possible, but unlike event, that costs increased more than ten percent in one year, EPA would also want the ability to reassess costs in less than one year. The permit retains the condition that if plugging and abandonment costs decrease by greater than ten percent, the financial assurance mechanism can be modified accordingly. An example of when this might occur is if PGV were plugging and abandoning wells.
- **70.c.** Comment: (92.38) II.G.1.d. A commenter stated that the financial assurance mechanism should be modified immediately to reflect changes of valuation upon the completion of new well construction.
- **70.c. Response:** Under condition II.G.1.d of the permit, EPA requires the financial assurance mechanism to be modified to reflect the new cost of plugging an additional well prior to the construction of the new well.
- **70.d. Comment:** (3.8, 4.7, 85.10, 86.6, 118.3, 123.3) A few commenters stated that the permit shouldn't be issued until insurance or liability coverage is available to cover a worst-case senario, including coverage of all harm to the community. A commenter also asked if EPA was liable because it furnished the permit to PGV?

70.d. Response: The permit requires that PGV posts an irrevocable letter of credit and standby trust of \$417,200 to cover the cost of a third party plugging and abandoning the three existing injection wells. If PGV drills more injection wells, the amount will need to be increased to cover the new actual cost of plugging and abandoning the wells. It is PGV's responsibility to be in compliance with the permit conditions, UIC regulations, and Safe Drinking Water Act.

The UIC Program does not authorize EPA to require liability insurance. However, under §13-183-35, DLNR requires liability coverage in addition to their bond requirement under §13-183-34. The amount of the public liability and property damage insurance is determined by the Land and Natural Resources Board and is for injuries to persons, wrongful death, and damages to property caused by any occupancy, use, operations or any other activity on leased lands. Liability coverage for explosion, collapse, and underground hazards are to be included prior to any drilling of a well for geothermal discover, evaluation or production. §13-183-51 covers compensation to occupiers of state or reserved lands, which is negotiated in good faith, for damages to occupier's crops, improvements, or surface of the land caused by the mining lessee's operations. Additionally, Condition #38 of the County's Geothermal Resources Permit states that the permittee shall obtain and maintain builder's risk and comprehensive liability insurance for project construction and operation activities.

70.e. Note: Condition II.G.1, which requires that financial responsibility and resources to be maintained for injection wells no longer serving their original purpose, has been clarified to show that this includes injection wells that are used for monitoring purposes.

1. Re: Effect of Permit (III.A)

71.a. Comment: (108.105) PGV objects to the language "may otherwise adversely affect the health of persons" stating that EPA has no jurisdiction to include this.

71.a. Response: That language is directly from 40 CFR §144.12(a). Part 144.12(d) also gives EPA jurisdiction to act whenever it "learns that a Class V well may be otherwise adversely affecting the health of persons". Refer to Response 2.d for other citations regarding protecting human health and the environment.

72. Re: Transfer of Permits (III.B.2)

72.a. Comment: (108.106) PGV commented that for permit transfers the UIC program does not require that an application be submitted, and thus the requirment of an application should be deleted. In addition this requirement is unclear.

72.a. Response: According to 40 CFR §144.38, a permit may be transferred by automatically transfer, minor modification, modification or revocation and reissuance. Section 144.39 on the modification or revocation and reissuance of permits refers to §124.5(c), which states that EPA may require the submission of an updated application for a permit modification other than a minor modification; and EPA shall require the submission of a new application if the permit is revoked and reissued. The application refered to in III.B.2 is this type of application. If the permit is automatically transfered under §144.38(b), then only the information required in §144.38(b)(2) is required. Condition III.B.2 is modified in the final permit to clarify the steps and different methods of transferring a permit. Requiring an application is authorized under §144.31. The new owner/operator (transferee) would be required to submit the application because they would be applying for the permit and would have knowledge of any new operating conditions.

72.b. Comment: (108.107) PGV commented that the permit language, "EPA may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary", should be deleted because it give EPA discretion to include

any addition requirements it determines to be necessary.

72.b. Response: The language PGV wants to delete is paraphrased from §144.38(a). Additional authorization for collecting information during permit modifications is found in §124.5(c) on modification revocation and reissuance, or termination of permits, "[T]he Director may request additional information and, in the case of a modified permit, may require the submission of an updated application. In the case of revoked and reissued permits, the Director shall require the submission of a new application." A site visit to the facility for any reason (including information collection) in conjunction with the processing of an application during permit processing is also authorized under §124.3(e). The final permit is modified to reflect the different authorities for information collection.

73. Re: Inspection and Entry (III.E.7)

- **73.a. Comment:** (92.39) Native Lands Institute commented that PGV should also be required to allow community residents to have access to and copy any records kept under the conditions of this permit, and to inspect any facilities, equipment, practices, or operations regulated or required under this permit, and to sample or monitor for the purposes of assuring permit compliance.
- **73.a. Response:** Community residents do not have the training and certification necessary to conduct UIC inspections for the EPA. In addition, EPA does not have the authority to require PGV to allow public access to its facilities. If people want access to compliance information, all reports required by this permit are available to the public under 40 CFR §144.5.
- **73.b.** Comment: (108.108) PGV commented that the language "at reasonable times" should be added to subparts (b), (c), and (d) as authorized by 40 CFR §144.51(i)(2-4).
- **73.b. Response:** The final permit contains the recommended language for consistency with 40 CFR §144.51(i)(2-4).

74. Re: Records of the Permit Application (III.E.8)

- **74.a. Comment:** (108.109) PGV commented that the words "for EPA" should be deleted from Part III.E.8 because it is confusing.
- **74.a. Response:** The words "for EPA" are in this condition to highlight the requirement that PGV must keep all data required to complete the permit application and any supplemental information submitted with the permit application for five years for EPA, as opposed to possibly different requirements for DOH permit application material.

75. Re: Availability of Reports (III.E.9)

- **75.a. Comment:** (108.110) PGV commented that having permit applications, permits, and well operation data available to the public is not authorized by statute. Section 1445 of the SDWA says that any information required to be submitted must be considered confidential where that information "if made public would divulge trade secrets or secret processes of such person." The UIC program allows an applicant to make a confidentiality claim over any information submitted in the application. Both the permit and the permit application may contain trade secrets and secret processes. It is a crime to divulge CBI that is not authorized for disclosure under law according to 18 USC §1905.
- **75.a. Response:** Part III.D states "[I]n accordance with 40 CFR §§ 2 and 144.5, any information submitted to the EPA pursuant to this permit may be claimed as confidential by the submitter. Any such claim must be asserted at the time of submission by stamping the words 'confidential business information' on each page containing such information. If no claim is made at the time of submission,

the EPA may make the information available to the public without further notice." PGV's application was not claimed to contain confidential business information (CBI), nor is it stamped as such. Intially, PGV claimed large portions of the application as being CBI. A few months later, PGV withdrew this claim with the exception of a few pages that PGV claimed to still contain CBI. EPA let PGV replace those pages with pages that did not contain CBI. PGV cannot now claim that the application contains CBI. The permit, being based on information from the application, does not contain CBI. Additionally, in a January 14, 1997 letter, EPA denied PGV's earlier claim of confidentiality on information used in the National Enforcement Investigation Center report (see letter #201321-201322).

Finally, note that 40 CFR §144.5 states that "(b) Claims of confidentiality for the following information will be denied: (1) The name and address of any permit applicant or permittee; (2) Information which deals with the existence, absence, or level of contaminants in drinking water." The well operation data is required to determine the latter, and therefore a claim of confidentiality would be denied. Additionally, EPA is requiring the same monitoring data that PGV has been submitting without a claim of confidentiality to DOH for over the last five years. As stated above, similar information, gathered during the February 1995 National Enforcement Investigation Center inspection, was declared CBI by PGV. On January 14, 1997, EPA denied this claim of confidentiality (see letter #401003-401013).

- **75.b. Comment:** (108.111) PGV commented that Part II.E.9, which states that "permit applications, permits, and well operation data shall not be considered confidential", contradicts Part III.D, which allows PGV to make a confidentiality claim for "any information submitted to the EPA pursuant to this permit."
- **75.b. Response:** There is no contradiction between III.D and III.E.9, because PGV can still claim as confidential business information "any information submitted to the EPA pursuant to this permit." However, if the information deals with the existence, absence, or level of contaminants in drinking water, then it will be denied according to §144.5. As for the application and permit, they are not confidential for reasons described in Response 75.a.

76. Re: Anticipated Changes and Noncompliance (III.E.11.a)

- **76.a. Comment:** (92.40) Native Land Institute commented that notice of anticipated changes and noncompliance should be given to EPA and Puna Malama Pono at least 60 days in advance to allow EPA time to fully investigate health consequences.
- **76.b. Response:** EPA believes seven days of advance notice is sufficient. As noted in this condition, changes, modifications or revisions in the operation characteristics or specificiations of the injection wells shall not be implemented unless otherwise approved by the EPA. EPA will make this information available to Puna Malama Pono or any other member of the public who requests it.

77. Re: Twenty-four Hour Reporting (III.E.11.b)

- **77.a. Comment:** (92.41) Native Land Institute commented that 24-hour reporting should be to both EPA and Puna Malama Pono.
- **77.a. Response:** Because this reporting is triggered by noncompliance that may endanger a USDW in addition to human health and the environment and therefore is not confidential business informantion under §144.5, EPA will notify Puna Malama Pono or any other member of the public who requests this information.
- **77.b.** Comment: (108.112) PGV commented that Part III.E.11(b) should be deleted because it repeats the reporting requirements in Part II.E.17. For the reasons stated in PGV's comments on Part III.A, the words "may adversely affect the health of persons" should be deleted from Part III.E.11(b).

77.b. Response: For permit conciseness, Part II.E.17 is moved to Part II.E.11, the section on reporting of changes and noncompliance, and combined with II.E.11(b), the part on twenty-four hour reporting. In the final permit, Part II.E.11 cites 40 CFR §144.51(l)(6), the part on twenty-four hour reporting. Part I44.51(l)(6) specifically states that "[T]he permittee shall report any noncompliance which may endanger health or the environment...." EPA will keep this language because conditions in §144.51 apply to all permits.

78. Re: Other Noncompliance (III.E.11.c)

- **78.a. Comment:** (108.113) PGV commented that the conditions in Part III.E.11(c) are covered by Part II.E.18, so Part III.E.11(c) should be deleted. There is nothing in III.E.11(c) that is not already covered by II.E.18.
- **78.a. Response:** For permit conciseness, Part II.E.18 shall be moved to and combined with Part III.E.11(c). Part III.E.11(c) includes reporting on "noncompliance not otherwise reported at the time monitoring reports are submitted" which is unique and shall be kept in the final permit.

79. Re: Other Information (II.E.11.d)

- **79.a. Comment:** (92.42) Native Lands Institute commented that corrections or relevant facts not submitted in reports to EPA should be submitted Puna Malama Pono in addition to EPA.
- **79.a. Response:** In accordance with §144.5, EPA will notify Puna Malama Pono or any other member of the public who requests this information

80. Re: Permit Extensions (III.E.12.b.iii)

- **80.a. Comment:** (108.114, 122.5) PGV and another commentor remarked that this paragraph is difficult to understand. PGV suggested that it be reworded to read as follows: "The new permit has not been denied, or if the new permit has been denied, the denial has been appealed and the appeal is either still pending or has resulted in a reversal of the denial of the new permit application."
- **80.a. Response:** That condition is from §144.37(a)(1-2) which does not include the confusing language. Therefore it is deleted from the permit.
- **80.b. Commenter:** (122.6) One commenter asked whether PGV could continue to oerate while they appeal a permit denial and for how long? If EPA finds at some point it must terminate the permit because of a hazard to human health or contamination of the ground water, can EPA rewrite this condition so that it makes the existing permit null and void. This would prevent PGV from operating under the existing permit while PGV appeals the denial of the permit.
- **80.b.** Response: It is unnecessary to add a permit null and void condition condition to the permit because UIC regulations address that circumstance. 40 CFR §144.12(d) states "Whenever the Director learns that a Class V well may be otherwise adversely affecting the health of persons, he or she may prescribe such actions as may be necessary to prevent the adverse effect, include any action authorized under paragraph (c)..." which includes well closure. Section 144.40(a)(3) allows EPA to terminate a permit if "A determination that the permitted activity endangers human health or the environment and can only be regulated to accceptable levels by permit modification or termination". Additionally, under §144.24(c)(1), an owner or operator is prohibited from injecting upon permit denial. If PGV was not in compliance with the conditions of the permit when it expired, EPA could issue a notice of intent to deny the new permit. If the permit is denied, the owner or operator would then be required to cease the activites authorized by the continued permit or be subject to enforcement for operating without a permit according to §144.37(c)(2).

81. Re: Required Immediate and Followup Notifications of Non-permitted Releases (III.E.13)

- **81.a. Comment:** (92.43) Native Lands Institute commented that the proposed permit condition here reads: "The permittee will immediately notify...as soon as it has knowledge that there has been a release into the environment of a reportable quantity of a hazardous or extremely hazardous substance." "Reportable quantity" is not sufficiently defined. Puna Malama Pono should be notified in addition to the National Response Center, the State Emergency Response commission, and the Local Emergency Planning Committee. What standards are being used for protection of human health in instances of the release of a reportable quantity of a hazardous substance?
- **81.a. Response:** Under CERCLA, whenever a release of 100 or more pounds of hydrogen sulfide occurs, a facility is required to immediately notify the National Response Center (see May 5, 1994 EPA press release). Hydrogen sulfide is a CERCLA "hazardous substance" and an EPCRA "extremely hazardous substance" (see September 9, 1994 Consent Agreement and Consent Order #09-94-0014). Puna Malama Pono or anyone else who is interested should contact their Local Emergency Planning Committee with this request to be notified when there is a release into the environment of a reportable quantity of a hazardous or extremely hazardous substance.
- **81.b. Comment:** (52.2, 120.2) Two people commented that PGV has never admitted having any problems and has never reported a single blowout, leak or uncontrolled emission.
- **81.b. Response:** EPA has included condition III.E.13 which underscores the need for PGV to contact the appropriate entities when reportable releases of hazardous or extremely hazardous substances occur.
- **81.c.** Comment: (108.115) PGV commented that this condition is not authorized because CERCLA and EPCRA reporting requirements are unrelated to the protection of USDW's. CERCLA and EPCRA go far beyond protecting drinking water; they also involve releases of hazardous subtances to ambient air, land surface or subsurface strata, etc., in addition to sources of drinking water according to 42 USC §9601.
- **81.c. Response:** As the commenter stated, the release of hazardous substances to drinking water is covered by CERCLA and EPCRA, in addition to the SDWA. An example of a situation where all three of these statutes come into play would be a blowout of an injection well, which can trigger CERCLA and EPCRA reporting in addition to reporting requirements under the SDWA. Part III.E.13 is a reminder to PGV to notify appropriate entities when reportable releases of hazardous or extremely hazardous substances occur.
- **81.d. Comment:** (101.2) A commenter wrote that there seemed to be a significant lack of understanding of whom is responsible for notifying residents of incidents as well as the permit requirements for agency notification by PGV. Complaints in this areas need to be addressed by Civil Defense.
- **81.d. Response:** One intent of this condition is to clarify what agencies should be notified. PGV had a very good chart in the 6.1 version of its Emergency Response Plan that specified what agencies should be contacted under different scenarios. The 6.3 version lacks this comprehensive chart. As for who is responsible for notifying residents, the commenter is correct in that Civil Defense notifies residents regarding emergencies/evacuations.

82. Re: Appendix B

82.a Comment: (108.116) PGV noted that this Appendix uses a map of the PGV facility that does not

show the location of the proposed new well pads. In contrast, the map issued in conjunction with EPA's recent public notice does contain the proposed well pad locations. PGV suggest that the newer map be used.

82.a. Response: When the draft permit was issued, PGV had not submitted the location of proposed well pad locations for the draft permit. It was at the April 3, 1998 public hearing that PGV submitted that information, which was subsequently shared with the public in the second public notice. In the final permit, EPA will use the map that PGV submitted at the public hearing which was sent out in the second public notice.

83. Re: Appendix H

83.a. Comment: (108.117) Regarding the the table entitled "Test Parameters for Type I Sample", PGV notes that the parameter for isopentane is unnecessary. PGV uses N-pentane rather than isopentane. The sulfur parameter identified should be "total sulfur". The sulfur present is elemental, and there is no chemical analytical method for monitoring it. PGV also suggested that the language concerning the use of a cooling coil to cool the samples should be deleted. The permit should not specify the particular technology used for cooling samples, as the best technology for cooling may change.

83.a. Response: EPA duly notes that PGV uses N-pentane rather than isopentane and the final pemit reflects this correction. EPA is monitoring for N-pentane to ascertain that PGV's system is a closed loop system. Total sulfur will be monitored for rather than sulfur. The NEIC inspection report noted that PGV did not use a cooling coil to cool fluid samples during collection. The report stated that "The existing injectate sample cooling equipment does not provide sufficient cooling to maximized retention of volatile components in the sample. Injectate samples should be further cooled prior to collection. The collection sample temperature should also be recorded" (see NEIC report #401034). Cooling samples with a cooling coil is an inexpensive standard practice according to geothermal sampling experts at the U.S. Geological Survey and the U.S. Department of Energy, and what EPA personnel have observed at other geothermal sites. Cooling the sample facilitates the retention of volatile organic compounds in the fluid. If PGV finds a better technology for cooling samples during collection, the permit can be modified to reflect this.

84. Re: Scope of Permit and Response to Comments

Comments were made on the following topics: reliable power, jobs, royalties, community service, safe clean energy, polluting uneconomical enegry, economy, rolling blackouts, fossil fuel plant emmissions, global warming, RICO, U.S. Public Law 103-150, hydrogen sulfide, air emissions, air residues from plant, catchment systems, H2S in production wells, plummetting property values, rain forest, home insurance, PGV having the capacity to supply 19% of the Island's energy versus 25%, cost of public hearing, states' rights, unfunded federal mandates, Hatch Act, Federal Advisory Committee Act, Geothermal Royalty and Asset Funds, ATSDR health study and Dr. Marvin Legator, support or opposition to the project, geothermal oversite in other states, air permit and BACT, County enforcement of the GRP, Section 409 of the Disaster Relief Act, Hazard Mitigation Team Report for the Kilauea Volcano FEMA-864-DR-HI October 1990, pentane, PM10, sulfatreat machine, Hawaiian Kingdom Law, Petition for Writ of Mandamus, 1850 Treaty of Friendship Commerce and Navigation, testing catchment water for pesticides and geothermal, gifts of food and leis, Running Grass, vog, mold, corrosion, home prices, real time air monitoring, relocation, Dr. Sam Ruben, genocide, asthma, EMFs, elevated fetal and infant dealths, learning disabilities, lead testing, Hawaii Externalities Project, sustainable water delivery system, regional revitalization, Maoris, cost of geothermal energy, selective energy discounts, air quality issues, State fiduciary responsibility for geothermal reservoir, air pollution, assessing impacts of coal and oil fired power plants, alternative energy sources, conservation, land use planning, seismic and volcanic

hazard risk assessment, ozone, carbon dioxide, property insurance, and effects on roofing, landscaping, plants, and building materials. These topics fall outside the scope of the UIC permit.